From:

Productivity Measurement in the Service Sector

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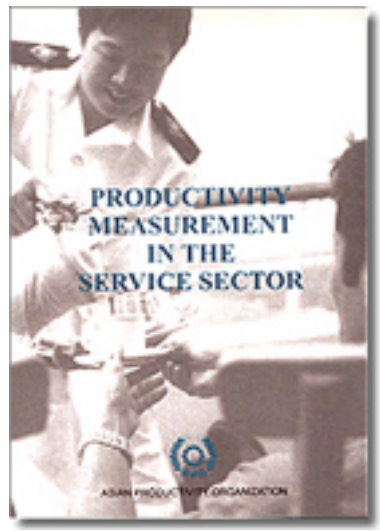
Report on the APO Symposium on Productivity Measurement in the Service Sector

Kuala Lumpur, Malaysia, 1-4 August 2000
(SYP-12-00)



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PRODUCTIVITY MEASUREMENT IN THE SERVICE SECTOR

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TABLE OF CONTENTS

SUMMARY AND CONCLUSIONS

INTRODUCTION

The APO has been addressing productivity measurement methodologies and standardization criteria since 1979 with a view to enabling members to measure changes in productivity and make comparisons across countries. Over the years, several workshops, surveys and symposia have been organized by the APO to study and review techniques and approaches within member countries.

Recently, it was discovered that measurement had been undergoing some radical changes and this symposium was designed to address those changes with particular reference to the service sector. This sector is assuming an ever-larger role in national economies in terms of both output and employment. Thus, understanding and measuring productivity within it will become increasingly important for member countries in their endeavors to raise productivity and living standards.

Indeed, dramatic changes continue to take place in both the economic and social environments of the globalized world in the 21st century. Industries are restructuring and reshaping to effectively meet the challenge of highly competitive and complex domestic and world marketplaces. The service sector is no exception. In fact, it accounts for a significant share of Information Technology (IT) investment, generating new configurations for, and applications of, this advanced technology. Yet productivity growth in many service industries has been classified as weak. While some perceive that IT has no payoff in terms of productivity growth, others attribute the lackluster productivity estimates to an inability to measure productivity changes in services arising from innovation and the use of technology.

As companies transform themselves to compete in the new digital economy, their ability to exploit intangible assets such as intellectual capital becomes more decisive than their ability to manage physical assets. Intangible inputs such as knowledge, motivation and information assume added importance because of their role in inducing the innovation essential for improving productivity. The challenges confronting the service sector in the 21st century will undoubtedly influence the way in which we account for productivity improvement.

In the knowledge era, the concept of measurement remains vitally important and relevant but it has to be addressed in a wider context. This has much to do with the pursuit of business excellence. To achieve outstanding business results, organizations must put in place world-class systems and approaches. This will also entail measuring performance in key result areas, which will focus on creating and balancing values for *all* stakeholders - customers, employees, shareholders, suppliers, and the community at large. This is why new tools such as the Balanced Scorecard (a balanced composite of leading and lagging performance measures addressing all stakeholders) and Economic Value Added are becoming popular. These and similar tools provide the means for management to focus on creating value-added, improving results, communicating priorities and monitoring performance.

Clearly, approaches to productivity measurement cannot remain static but have to undergo significant changes in line with the evolution of management thinking and shifts in the productivity paradigm. Traditional productivity measurement approaches that simply relate output to input consumed no longer constitute adequate indicators of business performance. Rather, an outcome-oriented approach that embraces a clearly defined mission, vision and business outcomes for each organization provides a better reflection of economic health and growth prospects.

Altogether 20 participants from 14 member countries contributed to the deliberations. The program included presentations by resource persons from Japan, Botswana, and Malaysia, and country paper presentations by the participants. These were followed by syndicate discussions to arrive at conclusions and recommendations at the macro and enterprise levels for action and follow-up by the APO, the respective governments and NPOs of member countries, and individual organizations. The conclusions and recommendations are summarized below.

CONCLUSIONS

Measurement and measures can be viewed from a number of perspectives. Measures appear to have been applied in order to raise awareness, restore control and promote performance improvement. It is clear that they fall into several categories and taxonomies. They can be classified as to their construction - partial, multiple, input or total factor; or as to the level of their application - national, industry, organization, or individual; or as to the nature of the contrast employed - over time, spatial or normative.

Over the years, an impressive array of measurement approaches has emerged. These measures unequivocally provide support for the improvement process and are of particular benefit in service and white-collar situations (although they may not have been specifically designed for this purpose). All of them take, in one form or another, a systemic or integrative view. Many do this from a so-called 'family of measures' position. These range from the (now) ubiquitous Objectives Matrix to its more strategic and prescriptive successor, the Balanced Scorecard.

Today's business challenges have created the need for integrated performance measurement systems that are strategically linked to the organization's goals. However, there are significant implications for the design and implementation of performance measurement systems in service sector institutions if, indeed, performance improvement is the objective. The practitioner has to address the social or affective domain if measures are to be more than elegant mathematical abstractions. In service situations where the exercise of considerable discretion is possible, it is just as important that measures invoke appropriate action as it is that they are technically correct and, for this to happen, there has to be employee buy-in to the measures. This has been a major influence on the way measurement systems have been designed and deployed.

The experience of member countries has demonstrated that measuring productivity in the service sector is far more intricate than in the manufacturing sector. Some factors contributing to this intricacy echoed throughout the symposium and are highlighted below:

a. There is a need to have a common understanding of the term 'service sector' and to address the impact of changes in the scope of the sector whilst taking account of the different levels of development in different countries. Also, definitions must accommodate the blurring of differences between the service and manufacturing sectors and between private and public institutions. Without a common understanding of the service sector, international comparisons are not possible, notwithstanding the ambiguity or confusion that would inevitably arise. This is compounded by the fact that the term 'productivity' itself also varies in its meaning when interpreted or translated by different people and organizations, often being used interchangeably with 'performance'.

b. In giving effect to productivity measurement, difficulties are being experienced in specifying both the inputs and outputs of service sector organizations. Other considerations may impact both the input and output components of the productivity equation, making implementation difficult at either macro or enterprise level. These considerations include:

- Measurement of intangibles such as speed of response arising from information technology; innovation; job complexities; and intellectual capital;
- The availability of criteria that can be used to assess the suitability of output measures and what constitutes input for a particular output;

- Growth of the knowledge economy where employees and organizations need to continually learn in order to counter the effects of knowledge redundancy;
- Structural changes in the sector and economy;
- Classification of measurement in the service industry, i.e. in physical or monetary terms; and
- The lack of proper measurement and evaluation systems at enterprise level.

c. Also raised was the question of linkages or relationships between measurement, productivity improvement and other issues or activities such as:

- Translating the effects tracked by measurement to causes so that appropriate actions can be taken;
- Examining and accommodating individual stakeholder perspectives - for instance having separate metrics for each stakeholder group (customers, investors, employees, and communities);
- Defining performance indicators linked to business strategy, i.e. using measurement in a way that is congruent and supportive of organizational strategy and goals;
- The links between productivity (efficiency, effectiveness, and utilization) and quality, innovation, and quality of worklife;
- Connections between productivity, quality and costs, e.g. labor cost;
- Lack of corporate vision and objectives on which to base measures of progress;
- Lack of interest in measurement among top people in both private and public organizations;
- Little incentive to act on measurement results; and
- Lack of knowledge as to how to use measurement results for improvement purposes.

d. Each economic activity has special difficulties when it comes to measurement and those in the service sector are no exception. Getting measurement to work is much more than simply knowing technically how to construct measures. People - particularly service people - have to respond to those measures by taking action to improve. Finally, the ultimate objective of implementing measurement systems is to contribute to the improvement process by supporting organizational strategy and thereby avoid measuring for measuring's sake.

e. The shortage of good, current or timely data for analysis at both macro and enterprise level and the lack of support for organizing and managing the data further aggravates the application of measurement. Furthermore, not enough has been done in terms of standardization of measurement methodologies among member countries. At the enterprise level, the absence of good public domain data has proved to be a frustration. It was also noted that performance results are frequently inaccurate or distorted to disguise poor performance.

f. A number of motivational issues affecting the use of measurement at enterprise level emerged. These included:

- Negative attitudes of employees towards measurement (or being measured);
- Lack of commitment from top management;
- Lack of incentives/compensation systems to encourage measurement;
- Little awareness of the benefits of productivity and, therefore, its measurement; and
- Varying expectations regarding what constitutes an acceptable level of service.

g. Some concerns regarding structural issues that could affect productivity were also raised. These included arrangements within both private and public institutions that encourage interference and militate against the emergence of a professional management cadre. The fact that, in some countries, women are only minimally involved in economic activities was also seen as a barrier to productivity growth.

RECOMMENDATIONS

In response to the above findings, the symposium recommended the following actions by the stakeholder bodies:

The APO

a. Establish a joint study group to properly define the service sector and the terminology to be used, perhaps thinking in terms of a taxonomy from a demand side perspective. Productivity should be generic and qualified by specific activities and in terms of overall welfare at the company and national levels. The group should also identify and explore linkages to other issues such as:

- The status of the IT industry - it was suggested that IT could even be made a separate sector;
- Growth induced in other sectors by the service sector; and
- Understanding the underlying causes of performance change so that appropriate actions can be taken.

b. Conduct a survey to ascertain the extent to which the recommendations of the Malaysian symposium have been implemented.

c. In co-operation with member governments, rationalize the data/statistics collecting agencies in member countries for the purpose of facilitating the collection of standardized comparable data. In relation to data collection for analysis, there is not only the need to compile better and accurate data but also to have data that conforms to internationally established norms. Member countries should at least define such norms and identify a single organization in each country to collect the relevant data. In this regard, the governments could explore the possibility of assigning one of the existing agencies as a nodal body for collecting standardized data.

d. In co-operation with NPOs, develop and facilitate the phased introduction of a Standardized Data Dissemination System. Data could then be made available on the Internet for all member countries.

e. In relation to standardization of measurement methodologies, the APO could encourage the use of a common system and uniformity in productivity indicators in the service sector. For instance, it could continue to encourage the use of the ratio system or value-added productivity measurement at the firm level, which it has propagated among member countries. Such practical approaches nurture a common understanding for comparison, interpretation and subsequently adoption of improvement techniques to raise productivity levels. Alternatively, 'state-of-the art' total factor productivity approaches presented at the symposium could be considered. These would include productivity accounting or the translog production function for the service industry developed in Taiwan. Ultimately, the balance must be tilted towards an approach that combines robustness with ease of application and understanding by all concerned.

f. It was also suggested that the National Customer Satisfaction Index (NCSI) implemented in Malaysia could be adopted by other member countries. The results of sectoral and customer satisfaction surveys could be disseminated to industries and companies for corrective action and to serve as the basis for regional comparison.

National Governments

a. Develop and adopt a uniform data strategy that includes definitions of data requirements. As a start, it may be necessary for each member country to adopt one or two practical measures like the value-added measurement approach, perhaps incorporated into an Objectives Matrix or the Balanced Scorecard, as their basic measurement. Individual member countries could incorporate other techniques such as productivity accounting, knowledge management, benchmarking, etc. as their level of understanding of productivity and performance measurement improves.

b. Provide industry-wide incentives to engage interest in productivity and its measurement.

c. Provide *arm's length* but strong political support for NPOs.

d. Provide incentives for organizations to invest in intangibles such as R&D, management development, organizational development, innovation and knowledge management.

NPOs

a. The Malaysian National Productivity Corporation (in conjunction with the APO) should make recommendations on normalization of data that allows for the provision of both good and sufficient data for productivity measurement purposes.

b. Create a situation in the relevant agencies within their respective countries in which macro data for productivity measurement purposes is available within a six- to 12-month period.

c. Set up benchmarking databases, monitor performance levels at both macro and micro levels and conduct sectoral studies to establish the status quo with respect to productivity and performance measurement.

d. Create awareness of strategic processes and provide assistance with strategy formulation within organizations (encouraged by both the APO and national governments).

e. Hold workshops/seminars to raise awareness of productivity, its benefits and how to measure it, with particular reference to decision-makers and senior managers in both public and private organizations. Back this up by developing training programs on measurement in co-operation with individual organizations. Note that, due to the complexity, multi-dimensional success factors and key contributions by different stakeholders, no one single productivity measurement technique is likely to give a complete picture of an organization's performance. It will thus be necessary to understand and deploy integrated productivity and performance measurement and management systems such as control panels, the Objectives Matrix, the Balanced Scorecard, productivity accounting, Activity Based Costing, Throughput Costing, Economic Value Added, knowledge management, and benchmarking.

Individual Organizations

a. Develop and implement clear strategies, policies, systems, goals and objectives and see performance measurement as a strategic decision support mechanism.

b. Set up quality management systems and implement reliable performance management systems that support organizational strategy (mission, vision, goals and objectives).

c. Develop employee competence to the point where measurement is embraced and not seen as a threat and rejected.

d. Separate management from ownership so as to encourage and nurture a professional management cadre.

CONCLUDING REMARKS

With the service sector assuming an ever-larger role in national economies and taking up a greater share of employment and output, the symposium agreed that understanding and measuring productivity in this sector would become even more crucial for member countries in their efforts to raise productivity growth.

However, it is clear that the delegates from the 14 member countries represented at the symposium shared some serious concerns regarding the application of productivity and performance measurement in their countries and in the region. Not surprisingly, difficulties associated directly with designing and implementing measures appropriate to the service sector at both a macro and enterprise level were frequently cited (albeit for different reasons) as barriers to progress. These difficulties were compounded by a lack of consistent definitions of the service sector, loose terminology and poor quality data. Macro level concerns centered on a need to consistently make meaningful comparisons of performance across member countries whilst enterprise level concerns were more focused on ensuring alignment of measures with strategic direction so that actions would be taken that would result in productivity growth.

There was general acceptance that, in the service sector, traditional measurement systems were inadequate. A more integrated arrangement was needed at both macro and enterprise level and several 'family of measures' approaches were available from which to choose. Since motivation to use measurement seemed low, the choice would have be made carefully so as to balance robustness with acceptability.

CURRENT APPROACHES TO MEASUREMENT WITHIN THE SERVICE SECTOR & SERVICE SECTOR/WHITE COLLAR INSTITUTIONS

John Parsons
Chief Executive
Resource Alternatives (Botswana)

INTRODUCTION

The specific objective of this review is to provide, in some detail, a 'shopping list' of measurement approaches and techniques that are currently available to the practitioner, together with an appreciation of how they work and, therefore, when to use what in service sector/white collar environments. This will establish a degree of familiarity with the principles and methods of productivity measurement, with particular emphasis on measurement at the level of the system - industry, organization, division, department or work unit. Within that context, a broader objective is to introduce some definitional precision and thereby provide a common language that facilitates discussion on the measurement of productivity and performance.

Furthermore, since the emphasis will be more at organizational rather than macroeconomic level, a further objective is to demonstrate the crucial role that measurement plays in the improvement process so as to avoid measurement for the sake of measurement. Unless and until productivity grows at the level of our organizations, national productivity will not increase and neither living standards nor quality of life will improve.

Issues that will be addressed directly are operational definitions, the raison d'être for measurement, integrated measurement systems designed specifically to support improvement, some of the problems encountered with the design of measures in service/white collar situations and the connection between measurement and strategy.

W. Edwards Deming always insisted that tools and techniques should be considered only once purpose, attitudes and skills had been addressed. With this in mind, the roundabout route taken here to present what might seem to be a simple review of what's out there may appear less tortuous.

OPERATIONAL DEFINITIONS

According to Deming, an operational definition gives communicable meaning to a concept by specifying how the concept is measured and applied within a particular set of circumstances - criteria that provide an unambiguous description. In effect, an operational definition is one we can agree on, work with and, as far as is humanly possible, one that ensures everyone understands what is meant in the same way. What follows are some suggested operational definitions for measurement systems, productivity and performance measures. Also, the distinctions between direct, *first order,* and indirect, *second order,* measures are made.

Performance Measurement Systems within Economic Entities

Operational definition: Performance measurement systems comprise a set of coherent activities designed to enable management to determine, directly or indirectly, how an organizational system is performing - improving or deteriorating, in or out of control - whilst providing information in support of decisions and actions aimed at improving performance. Performance will always relate the outcomes or results to the resources expended. A performance measurement system embraces *the things we do to find out how we are doing and decide how we can do better*.

The distinction between a performance measurement system and any other measurement system is the notion of relating outcomes to resources (outputs to inputs). Thus, not all measurement systems relate to performance. An example would be a system that identifies managerial potential or the level of dissatisfaction with working conditions. The notion of an economic entity simply means that the organizational system being measured would typically comprise one or more value-adding processes.

Performance measurement systems cover the entire process of taking data, converting it to information and portraying the information (the effects) in a way that leads to insights regarding the underlying causes (knowledge). Recently, the purpose of a performance measurement system has been increasingly expressed in terms of its ability to reflect organizational strategies as well as the actions and interventions - planned or otherwise - of managers and employees. The connection between measurement and strategy will be explored in another paper, along with the use of terms such as key performance areas (KPAs), goals, objectives, strategic leverage areas and key performance indicators (KPIs).

Performance Measures

Operational definition: Performance measures represent quantitative expressions of how an organizational system was, is or should be performing. Measures are specific outcomes of that part of a performance measurement system that is concerned with manipulating dimensioned data in order to generate useful management information. Thus, performance measures are *numbers or combinations of numbers that tell us the level of performance.*

Performance measures are therefore a distinct sub-set or even a product of a measurement system. Measures can be dimensioned, dimensionless or a hybrid of dimensioned or dimensionless numbers. Furthermore, within the context of economic entities, the numbers can be expressed in terms of values, quantities or prices. Since it is performance that is being monitored, performance measures will relate outputs to inputs and permit contrasts to be made temporally, spatially or normatively.

Productivity Measures

Operational definition: Productivity measures represent a sub-set of performance measures that refer specifically to measurement expressed in quantity (physical or real) terms as against value or price terms. Thus, productivity measures are performance measures that use *numbers or combinations of numbers that tell us directly the physical level of performance.*

As with performance measures, productivity measures can be dimensioned or dimensionless. However, unlike performance measures, their dimensions will be expressed in physical terms or, if dimensionless, will be a quotient of two numbers expressed in identical physical terms.

Performance measures and productivity measures are not the same although each informs the other and productivity measures *are* a sub-set of performance measures. Thus customers served per man-hour is a measure of labor productivity. It is not the same as value added per employee, which is a hybrid labor performance measure, nor return on investment, which is a dimensionless, higher level, organizational performance measure. Despite the fact that labor productivity influences labor and organizational performance, there are other forces that impinge on both. Nevertheless, it would be surprising if labor productivity increased and labor performance did not and vice versa.

First Order & Second Order Measures

Operational definitions: First order measures of performance (which include productivity measures) provide information about performance directly rather than by inference. They measure directly the performance of the entity under scrutiny and are more concerned with outcomes. Second order measures provide indirect information about performance although they may not be measures of performance themselves. Second order measures measure things that affect the performance of the entity under scrutiny and are more likely to be drivers of performance.

Thus, if the number of new phones installed per work group per shift is a direct, first order measure of the productivity of telecommunications installation crews, then absenteeism within the crews would be an indirect, second order measure. Clearly, absenteeism as a surrogate for employee morale is not a performance measure in and of itself within the economic entity called 'installation'. Nevertheless, it is equally clear that absenteeism and morale will affect both present and, more importantly, future installation productivity.

None of the above operational definitions are set in stone. They are primarily intended to facilitate dialogue designed to generate a common language for that strategically important activity - the practice of productivity and performance measurement. And, in the process, stimulate some interesting debates that will challenge us as professionals in the field.

WHY MEASURE?

Improving the productivity of our organizations is essential to survival in a very competitive world. The purpose of all productivity-related endeavors is to bring about lasting improvements in performance. Productivity is also the best means we have to fight inflation, reduce unemployment, increase profits, reduce costs, create capital and wealth and improve the quality of working life. Management writer, Peter Drucker, clearly indicated the importance and relevance of measurement in the improvement process when he said: *"Without productivity objectives, a business does not have direction. Without productivity measurement, a business does not have control".*

The important role measurement plays in bringing about improvement was highlighted in a Delphi study reported under the auspices of the World Academy of Productivity Science. The study identified the root causes of failures in the implementation of productivity improvement initiatives and found that poor understanding and use of measurement was amongst the top five obstacles.

The 'measurement-is-meaningful' argument is supported by a survey of 300 firms in Britain, France, and Germany, the results of which were reported by Hubert and the European Association of National Productivity Centres. The report concludes that 75 percent of firms do not monitor or control productivity and less than 60 percent set performance targets for their departments. The motto of the consultancy conducting the survey was "If it matters, measure it" - advice equally applicable to white-collar and blue-collar operations within both the private and the public sectors. Conrad Viedge from the University of the Witwatersrand's Business School adds some strategic weight to these assertions when he states that "60 percent of organizations don't link budgets to strategy".

Measurement's most critical role may be to follow in the wake of organizational transformation and other improvement efforts such as total quality management, process re-engineering, benchmarking and productivity gainsharing. In their book *By What Method,* Morris and Sink announce that *"Measurement fosters organizational learning when management teams become skilled at converting data to information and information to knowledge".* And, the measurement has to be right since employees will respond to the signals. Eli Goldratt, author of the best selling book *The Goal*, put this succinctly when he said: *"Show me how you measure me and I'll show you how I behave".*

Thus, measurement enables individuals, organizations, and nations to establish where they are, to set goals as to where they want to be and to monitor progress towards those goals. Measurement is so important that it is no coincidence that one of the first and fundamental tasks of national productivity organizations has been to establish national productivity benchmarks. In all our economic endeavors the planning question has always been: *who's going to do what, by when, and how will we know it has been done?* Measurement addresses and then answers the last part of this question.

APPLICATION OF MEASURES

Productivity and performance measures seem to exist for three reasons, to:

- Raise awareness about productivity and performance;
- Establish control to restore productivity and performance; and
- Identify actions to improve performance.

Awareness Measures

Measures designed to raise awareness tend to be broad, aggregated system-wide indicators. At a national or regional level, these, according to the Southern African Development Community (SADC), *usually reduce to a ratio of net output (or value added) expressed in constant prices and the number of employees or labor hours worked.* SADC also suggests that total factor productivity is both more powerful and becoming more popular despite the need for a robust capital stock series to make it work.

Value added measures are also common at organizational level in both productivity/performance measures and in the construction of value added statements - made easier when tax regimes require value added to be calculated in any event. The inputs are usually expressed in terms of the value of labor compensation (salaries, wages, company contributions, etc.) or the number of employees. Similarly, organizations use coarse physical measures of output - like tons produced regardless of specification. Alternatively, awareness measures comprise the more traditional financial or management accounting ratios such as return on investment, return on sales and cost per unit produced or sold. When the primary objective is to raise awareness the emphasis is rarely on precision.

Control Measures

Control measures tend to be more rigorous, very clearly defined and often normative. Their purpose is to indicate when, and by how much, the performance of a particular process is deviating from what is expected so that performance can be restored. Often, they measure only a specific, narrowly defined, aspect of the production process and there is usually a bias towards traditional measures of labor productivity. Precision is greatest when pay and/or incentives are directly linked to performance.

Control measures are widespread in manufacturing or in the operational components of other economic sectors. Attempts have been made to introduce control measures into service and white collar/knowledge worker situations as an extension of organization and methods (O&M) activities. Clerical work and administrative productivity measurement systems have been designed and implemented along with standardized systems for tracking the execution of more technical activities such as computer programming.

Improvement Measures

Improvement focused measures reflect a more positive approach. This category is wide and embraces measures that diagnose and evaluate along with those that can be used for goal setting and feedback. Diagnostic and evaluation measures are designed to identify problems (or their symptoms), where they are, and their magnitude. The tendency has been to use more holistic, multi-factor measures or families of measures to get a better all-round view.

The growth of approaches such as the Objectives Matrix (OMAX), the Balanced Scorecard, and productivity accounting reflect earnest attempts to understand and resolve impediments to performance. Used in conjunction with appropriate questioning and investigatory techniques, diagnostic and evaluation measures can lead to uncovering the underlying causes of under-performance and suggest actions to improve. Because of its flexibility and easy acceptance, OMAX has proved particularly advantageous in service sector and white collar/knowledge worker environments.

At a strategic level, goal setting and feedback measures are used as an accompaniment to organizational performance improvement and transformation efforts and initiatives. Bottom line linked total factor approaches such as productivity accounting, measurement control panels (like the Balanced Scorecard), or systems incorporating both have become particularly popular as more and more organizations embark on strategy-driven, ongoing improvement programs.

TYPES OF MEASURES

Partials, MIPIs & Total Productivity

Partial productivity measures

Partial productivity measurement is probably the most commonly used technique. Partial measures relate output to one input used in the production process and typical examples of traditional partial measures are *customers served per employee per day, output per machine hour,* or *sales per square meter*. Such measures rely on their simplicity for their success. They are easily defined and provide quick results. They are eminently reliable where a single resource is dominant over the other resources and the resource mix tends to remain stable. The results obtained from partial measures may, however, be misleading as qualitative variations in products and resources are not accommodated since the measure often relies on unweighted quantities. Furthermore, since resources are looked at in isolation, the effects of resource substitution on productivity and performance may easily be ignored. A further disadvantage lies in their inability to reflect the financial impacts of productivity on bottom line results.

The resources available to all economic activities are broadly the same although they will be mixed together in completely different proportions. They are:

- Labor (people);
- Materials;
- Energy;
- Capital; and
- Outside services.

The ratio of the output to each resource measures the productivity of that resource. Thus, *labor productivity* is defined as the ratio of output to the labor input and *capital productivity* is defined as the ratio of output to the capital input. Examples might include:

$$\textit{Labor productivity} = \frac{\text{orders processed}}{\text{employee}} \quad \text{- in a warehouse}$$

$$\textit{Materials productivity} = \frac{\text{hamburgers served}}{\text{kg meat}} \quad \text{- at McDonald's}$$

$$\textit{Energy productivity} = \frac{\text{Passenger miles}}{\text{fuel used}} \quad \text{- for an airline}$$

$$\textit{Capital productivity} = \frac{\text{units sold}}{\text{sq.m floor space}} \quad \text{- in a supermarket}$$

Multiple input productivity measures (MIPI)

Multiple input productivity measures or indices are usually based on net output (value added) rather than gross output (production or sales). They are commonly used by economists. A multiple input productivity index (MIPI) is defined as:

$$\text{MIPI} = \frac{\text{Gross output - (Materials + Energy + Others)}}{\text{Labour + Capital}}$$

$$= \frac{\text{Value added}}{\text{Labour + Capital}}$$

Materials, energy and other expenses are subtracted from the output *and* are also excluded from the resources. Thus, those expense items purchased from outside suppliers are excluded so that only the 'value added' by the organization is considered. The productivity of the resources excluded - materials, energy, etc. - is measured indirectly through measurement of labor and capital.

Some caution must be exercised in the interpretation of MIPI results and the situation is often exacerbated because of the practice of expressing the output and inputs in money values, which are subject to change through inflation.

Total factor productivity (TFP) measures

As the name suggests, total factor productivity measures relate total output from the organizational system (not necessarily the entire organization) to *all* the inputs or resources used to generate that output. It is defined as:

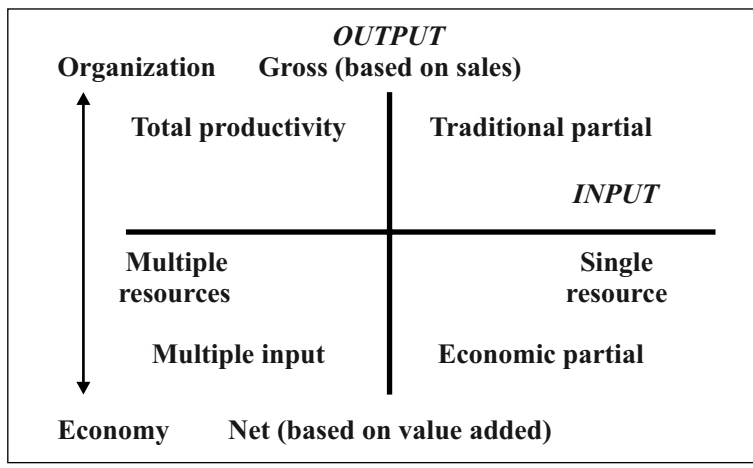
$$\text{TFP} = \frac{\text{Gross output}}{\text{Labour + Capital + Materials + Energy + Others}}$$

A well-designed total productivity measurement system will enable all the partials to be measured and then combined. This means that resources not ordinarily considered in constructing traditional partial measures are taken into account. Furthermore, trade-offs due to resource substitution can be tracked and analyzed and, because of TFP's system-wide focus, it becomes possible to reconcile the results of productivity measurement with the financial position of the organization. This has led to the development of productivity accounting approaches using the twin notions of productivity and price recovery to explain changes in financial performance.

Measurement Hierarchies

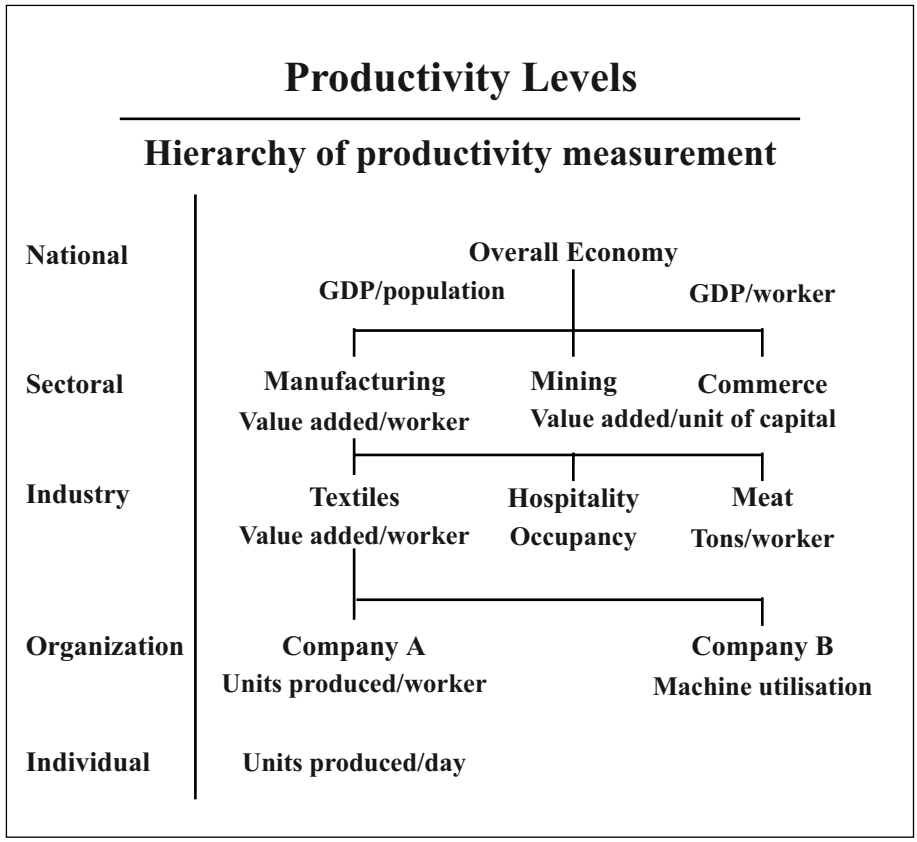
The types of measures that are used at macroeconomic level - industry, sector, economy - are often different to those used at the microeconomic level - organization, company. The figure below provides a taxonomy of measures in terms of level of application and multiplicity of resources.

Figure 1. Taxonomy of Productivity Measures



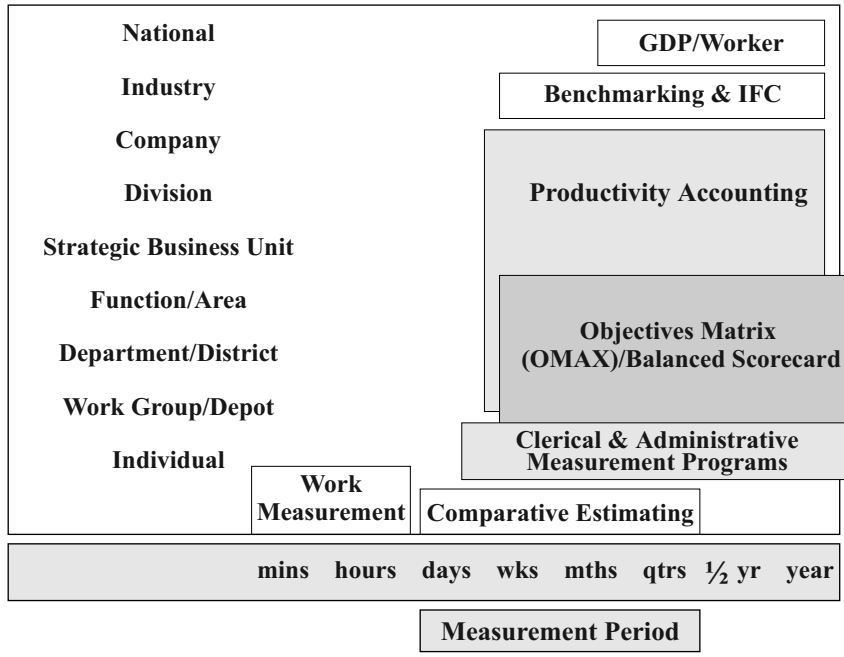
The Productivity and Standards Board of Singapore has adopted an alternative approach. It depicts typical measures likely to be used at various economic levels from the individual right up to the economy. It looks like this:

Figure 2. Hierarchy of Productivity Measurement ***(after PSB, Singapore)***



South Africa's giant electricity utility, Eskom, has also developed an overview of the appropriate application of measures and measurement systems within all of its operations and beyond. In addition, it has clearly indicated the frequency with which it believes the various measures could be applied. Understandably, the higher the level within the organization the more aggregated the measure becomes and the longer the time interval between measurement applications. Thus, where measures at the individual level might be taken within hours or even minutes of each other, it is unlikely that productivity accounting using TFP would be carried out more than once a month and more likely only once every quarter. The overview is shown in the next figure.

Figure 3. Appropriate Application of Productivity Measurement *(after Eskom)*



Time Series, Benchmarking & Norms

All measurement is by contrast of one sort or another. To state that productivity is 16 or 73 is nonsensical unless the figure can be compared with something. There are essentially three options from which to choose in order to make such a comparison:

- Past (or future) performance - time series/time lines - *temporal or longitudinal comparisons*;
- Performance of another operation - benchmarking, inter-firm comparisons (IFCs) - *spatial or cross sectional comparisons*; and
- Standard performance - budgets, engineered standards (time study), standard costing - *normative comparisons.*

An important distinction that needs to be made within the broad context of the three different types of contrast is that between levels and trends. The average American worker produces roughly 1.5 times the output of his Japanese counterpart yet, until recently, the rate of increase in output per worker has been significantly faster in Japan compared to America. Who is more productive? Clearly, the productivity of Japanese workers has been growing faster than that of American workers but that does not negate the fact that the level of productivity is higher in America than it is in Japan.

Time series

Performance in this case is contrasted across two time periods. Often these are contiguous periods - that is, periods that follow or are next to one another. Examples would include this month's performance versus last month's performance. Alternatively, comparisons are made of this month's performance versus the same month last year or the year before. A series of such results will enable a time series to be constructed that will indicate the *change* or *trend* in performance. As such, the results become amenable to statistical manipulation to gain further insights. Generally speaking this type of contrast will indicate whether an organization is getting better or worse.

Benchmarking

Cross-sectional comparisons embrace a range of measurement techniques that enable a single entity (organization, division) to compare its performance with that of other, often but not necessarily, similar entities. The older IFCs compare organizational performance against industry averages. The measures are usually ratios so that the differences in size are normalized.

Benchmarking brought a new dimension to cross-sectional comparisons. It is defined operationally by Kearnes of Xerox as "*the continuous process of measuring products, services, and practices against the toughest competitors or those companies recognized as industry leaders".* It is possible to make comparisons of one aspect of business operations with someone who is an industry leader *in that area* and compare another aspect with a different organization which happens to be the very best *in that area*. The focus is usually on practices and sometimes the best practitioner is found in another industry completely. For example, if an insurance company wished to compare its debt collection processes with the 'best in class' these would probably be found in institutions such as credit card companies rather than in another insurance company.

When IFCs and benchmarking are carried out it is necessary to decide how far to cast the net - similar institutions, all institutions, locally, internationally. Generally, cross-sectional comparisons will indicate whether the organization is better or worse than the best currently operating.

Norms

When performance is compared to a norm or standard - this month's actual versus this month's target results - variances are produced which can be favorable, unfavorable or zero. The nature of norms is usually very varied. They can be hard engineered standards such as might be derived from industrial engineering or work study, or they might be softer norms based on previous experience and management insights such as budgets and sales targets. For the first time, normative measures directly address the question of whether performance is good or bad.

MEASUREMENT APPROACHES DESIGNED TO SUPPORT IMPROVEMENT

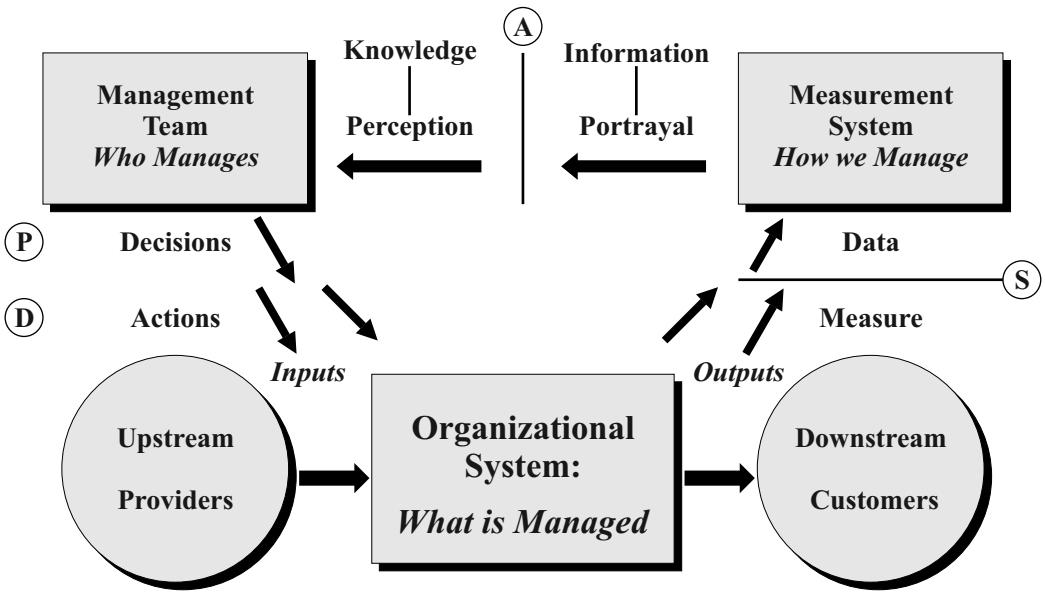
Designing measurement systems so that they enhance organizational performance rather than simply keeping score requires new ways of thinking. It means ensuring that measures are congruent with an organization's core purpose, vision, and strategic direction. *Simply put, this means directing effort at what counts rather than what can be counted.*

PDSA - from Data to Knowledge

All management teams are constantly taking decisions and actions aimed at maintaining and improving system performance. Measurement systems should be designed and deployed so as to ensure that these decisions are appropriate and that managerial actions are having the desired effect. The PDSA cycle - Plan, Do, Study Act (after Shewart, Deming and Juran) - assists in the process of converting *data* to *information* and *information* to *knowledge*.

Since decisions and actions have to be based on an understanding of what is *causing* changes to occur, the measurement system must be extended beyond the *effects* that such systems normally track. The cycle, long known in systems and quality management circles, was adapted by Kurstedt, Sink and Tuttle into a management systems model. The following figure shows how well the PDSA cycle integrates with this extended system of stakeholders.

Figure 4. From Data to Knowledge - the PDSA Cycle *(after Kurstedt)*



The management process outlined above is comprised of three basic components:

- The value-adding organizational system - *what is being managed*;
- The measurement system - *how we manage using appropriate tools and techniques*; and
- The management team - *those who manage.*

Portrayal, Decisions & Actions

There also exist three interfaces between the components and these are:

- The decision to action interface at Ⓟ and Ⓓ ;
- The measurement to data interface at Ⓢ ; and
- The portrayal (information) to perception (knowledge) interface at Ⓐ .

The measurement system captures an event occurring within the extended system and converts this data into information. This might mean ordering it, manipulating it, or performing calculations on it. Through the portrayal of the information and the skills and experience that the management team brings to interpreting it, new knowledge of what is happening within the organizational system is perceived.

Portrayal might mean performing a statistical analysis, benchmarking, or bringing various pieces of information together so that greater insights are possible and then presenting the results in a way that makes assimilation straightforward. The essential process is one of converting understanding of the effects occurring within the extended system into understanding of the underlying causes. Without this, the final steps of decisions and actions (planning and doing) are not possible.

MEASUREMENT METHODOLOGIES APPLICABLE TO SERVICE SECTOR & WHITE COLLAR/KNOWLEDGE WORKER ENVIRONMENTS

What follows is a brief introduction to seven distinct measurement approaches. These are consistent with the notion of systems thinking and they clearly distinguish between data and information, putting users well on track for converting information to knowledge. Although all seven have application in any economic environment, most have all been used with spectacular results in either service sector and/or white collar/knowledge worker situations. The seven approaches are:

- Control panels
- The Objectives Matrix - OMAX
- The Balanced Scorecard
- Productivity accounting
- Throughput costing
- Economic Value Added - EVA.
- Integrated Business Control - IBC

Control Panels

Measurement control panels represent a means of making visible a 'cockpit' of instruments conveying vital information about the organizational system under review. Control panels are built based on Kurstedt's management systems model.

Figure 5. The Extended System & Eight Performance Criteria ***(after Sink & Morris)***

As can be seen in the figure, within the extended system an array of eight performance criteria can be defined. These are:

- Effectiveness
- Efficiency
- Utilization
- Quality
- Productivity
- Innovation
- Quality of worklife
- Profitability

Effectiveness

Effectiveness is an output-side or results measure. It is about the identification of the right objectives - 'doing the right things' - and taking actions that achieve those objectives. The term 'right' implies that effectiveness incorporates an element of judgement, uncertainty or risk in interpreting what, for example, the internal customer or the marketplace will want. In answering the question "Am I working on the right thing?" being effective can be achieved through:

- *Screening* out what nobody should be doing;
- *Delegating* what should be done but not by you; and
- *Planning* to achieve the best result now and in the future.

Efficiency

Efficiency is an input-side or resource conversion measure that addresses the question of how what is being done can be better executed. It is concerned with the conversion rate of resources into products and services. Efficiency is irrelevant unless effectiveness exists since there is little merit in being 100 percent efficient if the work should not be done at all. Most traditional productivity textbooks have concentrated on efficiency yet, in a world where the orientation is rapidly moving towards service, it is responsible for relatively small improvements in overall performance.

Utilization

Utilization (sometimes referred to as occupancy) is concerned with whether resources - people, machines, materials - are working or waiting. It is a simple coefficient that converts calendar, or elapsed, time into real production time. If equipment or people are available for production for eight hours a day but only produce for six, their utilization level is 75 percent.

Quality

Quality is pervasive throughout the entire organizational system. It is variously defined as 'conformance to specification' or 'satisfying (even delighting) customers'. Although it is closely linked to (or even a sub-set of) effectiveness, it can be defined more operationally and in a way that facilitates measurement and that is consistent with the concept of the extended system.

The extent to which an organization is defining, measuring and managing performance at each of five quality checkpoints gives a clear indication of whether total quality is being managed.

The five quality checkpoints are as follows:

- *Quality checkpoint 1* is the selection and management of the upstream/provider systems;
- *Quality checkpoint 2* is incoming quality assurance (goods inward);
- *Quality checkpoint 3* is in-process quality management;
- *Quality checkpoint 4* is outgoing quality assurance (final product); and
- *Quality checkpoint 5* is proactive and reactive assurance that the organizational system meets the needs of the customer both now and in the future.

Productivity

Productivity is the relationship between what comes out of the organizational system, in terms of quality products and services that satisfy human needs, and what goes into the organizational system, in terms of the resources consumed to generate those products and services. It is, in a sense, the direct aggregation of all the previous performance measures (the indirect, second order, or enabling, factors will also be addressed). Although there are other external influences that determine, for example, whether the organization is financially successful, there is no doubt that productivity has the most profound influence on long run organizational performance.

Innovation

Innovation is the creative and successful response to real or perceived changes in either the external or internal environment in which the organization operates. Although it is a response - reactive or proactive - to the present situation, innovation is more likely to impact on future rather than present performance. Innovation is thus a series of actions designed to enable or influence other performance criteria (such as effectiveness or efficiency) rather than a performance measure in its own right.

Quality of worklife (QWL)

Quality of worklife covers a multiplicity of factors. It represents the affective response of people in the organization to issues such as their job content, pay, benefits, job security, working conditions, co-workers, supervision, culture, training and development, autonomy, and skill variation. The extent to which employees are able to influence and modify how the work is performed also affects quality of worklife. It is concerned less with *what needs to be done?* and more with *why should we do it?*

Researchers in the United States discovered that, in almost all cases, job satisfaction is associated with productive behavior whilst stress and dissatisfaction are associated with non-productive behaviors. Since productivity is a combination of both technical and social processes, quality of worklife is an indicator of how well the social aspects are being managed. Low morale and motivation levels will lower productivity levels.

Profitability/Budgetability

Financial performance is usually the primary measure of business success and there is no doubt that those organizations that are more productive tend also to be more profitable. The concept of *budgetability* allows financial measurement to be performed in those organizations where the revenue is not available - for example in cost centers, government departments or internal services.

Objectives Matrix (OMAX)

OMAX is a group-based measurement, goal setting and motivational tool of particular use in situations that are less amenable to more traditional measurement approaches. Developed by Jim Riggs at the Oregon Productivity Center, it has been eminently successful and has found application in a very wide range of (particularly service and white collar/knowledge worker) situations in many countries around the world.

Figure 6. Objectives Matrix - OMAX ***(after Riggs)***

	Productivity Criteria						
	#1	#2	#3	#4	#5	#6	
Row A	5.5%	16%	13.3%	605	320	9.5%	Performance
	0	0	10	800	0	0	--10
	0.2	2	11	770	50	3	--9
	0.5	4	12	740	125	5	--8
	1	6	13	710	175	7	--7
	2	8	[14]	680	225	9	--6
	3	10	15	650	275	[11]	--5
	4	12	16	620	[325]	13	--4
	5	14	17	[590]	375	15	--3
	[6]	[16]	18	560	390	17	--2
	7	18	19	530	405	19	--1
	8	20	20	500	420	21	--0
Row B	2	2	6	3	4	5	Score
	5	10	20	30	15	20	Weight
Row C	10	20	120	90	60	100	Value
							INDEX 400

Scores

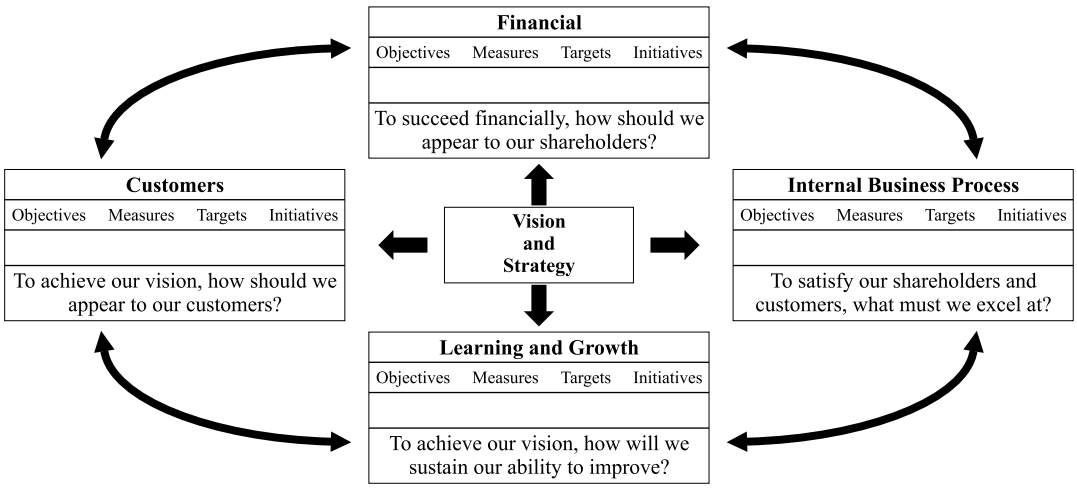
The rationale for, and value of, the matrix rests on its:

- Ability to normalize the units of the different measures specified;
- Flexibility in accommodating measures of quality, timeliness, safety, employee attitudes, productivity, and yields;
- Results/outcome orientation as against simply measuring activities; and
- Ability to measure trade-offs and produce a single, overall, measure of performance.

The Balanced Scorecard

Kaplan and Norton approached the idea of 360-degree vision somewhat differently. They took a more strategic view and the result was the very popular Balanced Scorecard. The scorecard prescribes four distinct goal categories or leverage areas: *learning & growth (including innovation), internal operations & business processes, customers,* and *financial.* A single action statement describes each goal category within the scorecard. For example, the category *internal operations & business processes* poses the strategic question: "To satisfy our shareholders and customers, what business processes must we excel at?" And, to ensure the connection to the organization's strategy, the discipline of the approach requires that, for each category, objectives are listed, measures are designed, targets are specified and initiatives are defined.

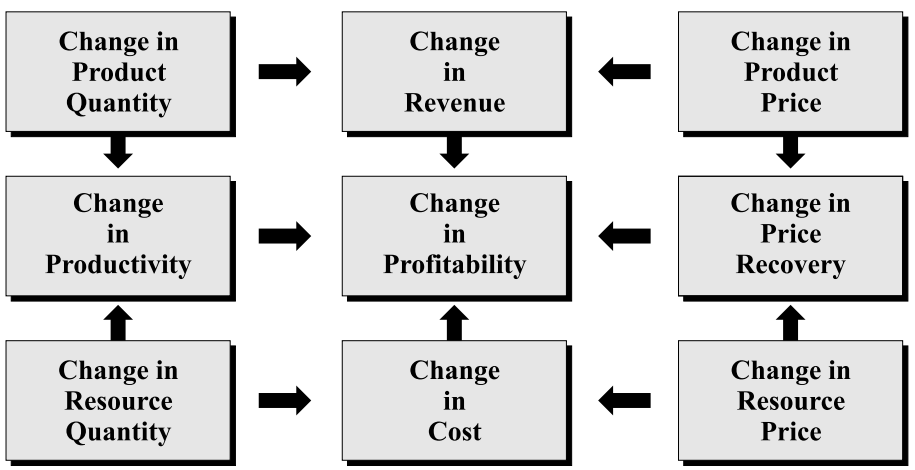
Figure 7. The Balanced Scorecard ***(after Kaplan & Norton)***



Productivity Accounting

Whereas the control panel, OMAX and the Balanced Scorecard use a family of measures approach, productivity accounting tends to be more robust, unambiguous and rigorously locked into the accounting system. Productivity accounting defines a clear relationship between profits, productivity and prices. This can be demonstrated using the nine-box diagram below:

Figure 8. Productivity Accounting - Sources of Profit Change



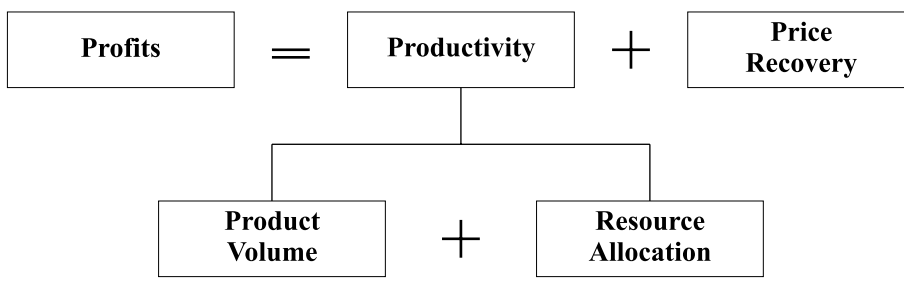
The figure shows that profits (financial performance) can only change through changes in productivity and price recovery. Thus, *under conditions of constant productivity and price recovery no changes in profits would occur!* Productivity will be constant only when the quantity change ratio for the products equals the quantity change ratio for the resources. Similarly, constant price recovery assumes that product price changes will equal those for resources. Productivity accounting uses these basic principles to explain changes in profits and profitability in terms of the contributions of productivity and price recovery change[9].

From a management response perspective, productivity changes are generally a function of what is happening inside the organization. One way or another, management is responsible for the technology being employed, the manner in which the value-adding processes are executed, and the markets in which the organization operates. On the other hand, price recovery changes are more a function of market forces. No single organization can consistently determine the prices it gets for its products or services nor can it determine the price it is going to pay for its raw materials, energy, labor, or outside services. Thus, management's response to a profit decline flowing from productivity loss should be quite different to its response to a profit decline resulting from an inability to recover resource prices in the market.

In common with OMAX, productivity accounting also produces a single bottom line score. OMAX generates an index of overall progress towards an array of goals, whilst productivity accounting generates a total factor productivity index and shows directly the contribution that productivity and price recovery are making to the financial position of the organization. Although the nine-box diagram shows the 'bottom line' as *profitability*, it could equally be *cost effectiveness*. Thus, productivity accounting works just as well (either alone or in conjunction with scoring matrices) in non-profit situations such as public sector institutions or cost centers within commercial operations[9].

The analysis can be further refined by showing the contribution to productivity change made by spreading the cost of non-variable resources (such as those associated with the use of capital equipment) over larger or smaller output volumes, separately from that resulting from management-induced resource allocation decisions (such as process improvements that reduce wastage or material consumption). The suite of measures thereby derived is shown below. For maximum benefit all the variances can be calculated for each and every resource and for total resources.

Figure 9: Productivity Accounting - Performance Variances



Productivity accounting, as a high-level executive reporting system, offers opportunities for evaluating both past and future performance. To work it needs a minimum of two data sets, although these could represent actual or budgeted periods for the same or different organizations. The results of a productivity accounting exercise are typically presented in two formats:

- A *variance analysis* reporting monetary contributions to profits, profitability, unit cost of production, value added (or whatever constitutes the bottom line); and
- A *strategic segment chart* portraying competitive posture.

Consider the following sample report:

Figure 10. Productivity Accounting - Profit Report

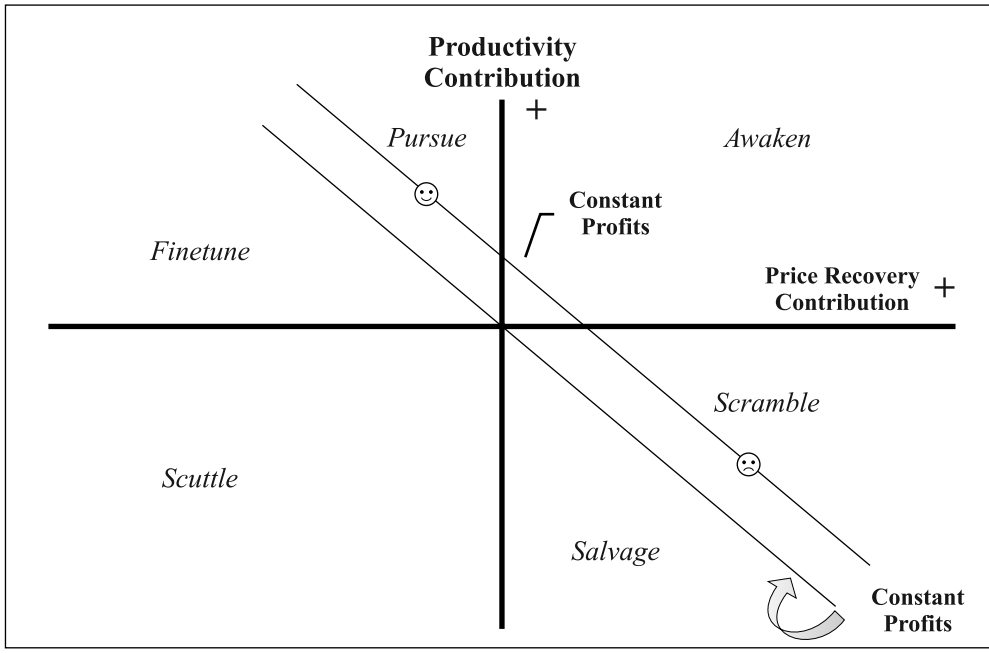
	All Values are in $000s					
		Contribution from				
Resources	**Profit**	**Productivity %**	**Productivity variance**	**Product Volume**	**Resource allocation**	**Price recovery**
	A	=	B B =	+ D +	E	C
Materials	47	3.5	35	0	35	12
Labor	(37)	(1.7)	(8)	5	(13)	(29)
Energy	(10)	11.3	7	3	4	(17)
Capital	2	(6.4)	(14)	1	(15)	16
Total	2	1.5	20	9	11	(18)

The results depicted in the report explain the changed profit position for a sample organization between two consecutive financial periods. Overall bottom line performance has improved by $2,000 as indicated in the total line of column A. Columns B and C show that this improvement is a consequence of a 1.5 percent gain in total productivity which contributed $20,000 and a price under-recovery which cost the organization $18,000. Furthermore, the $20,000 contribution from productivity growth (the amount of new wealth created) was derived from gains associated with spreading the cost of non-variable expenses over higher product volumes ($9,000 - column D) together with the net benefits derived from other resource allocation decisions ($11,000 - column E).

Column A displays the contribution each resource element (materials, labor, energy and, notably, capital) is making to the $2,000 profit improvement. Each dollar variance is broken down to reflect the contributions of productivity (both product volume and resource allocation effects) and price recovery. For example, labor productivity declined by 1.7 percent because of unfavorable resource allocation decisions whilst wage rates outstripped selling prices. Together this caused the labor cost ratio (labor cost as a percentage of sales) to deteriorate, negatively impacting profits by $37,000!

The *strategic segment chart* provides a graphic representation of the organization's competitive position.

Figure 11. Strategic Segment Chart



The six segments can be described as follows:

- ***Scuttle:*** A business in this segment is reducing profits due to both productivity losses *and* price under-recovery. It is unlikely that such performance could persist for any length of time before cash requirements took their natural toll.
- ***Salvage:*** This segment reflects declining productivity partially offset by price over-recovery or umbrella pricing. However, profits are still deteriorating and only restoring former productivity levels can retrieve the position.
- ***Scramble:*** This segment is similar to ***Salvage*** although profits are increasing because the benefits of the umbrella pricing exceed (and hence camouflage) the effects of the productivity losses. Furthermore, declining productivity reduces the performance requirements of newcomers to the market.
- ***Awaken:*** This position is more secure than either ***Salvage*** or ***Scramble*** as productivity is improving and making a positive contribution to profits. However, because of the price over-recovery, competitive entry is discouraged but not eliminated.
- ***Pursue:*** This result is characterized by productivity improvement and price under-recovery. The benefits of productivity growth are sufficient to finance a deflationary and, hence, competitive pricing policy. The high productivity and stringent pricing make a business in this segment very secure.
- ***Finetune:*** The price and productivity signals are the same as for ***Pursue*** but, since profits are declining, some fine-tuning is required.

Our sample organization finds itself in the ***Pursue*** segment. This position is strategically secure since any competing organization would need to move up its learning curve through productivity growth whilst having to accept tight pricing conditions (and low margins for anyone but the best) in the marketplace. The sample company created wealth through a 1.5 percent increase in total productivity and shared the benefits with its stakeholders. Explicit benefits were conferred on the owners of capital in the form of higher profits now and in the future, whilst implicit benefits were conferred on consumers by absorbing resource price increases.

The accounting system is insensitive to the origins of profit change. The $2,000 profit improvement could easily have arisen through price over-recovery, which subsidized, and thus masked, productivity loss or through a combination of productivity gains and price over-recovery. In other words, the sample organization could have been positioned *anywhere along the constant profits line* - within ***Scramble, Awaken*** or, as was the case, ***Pursue*** - whilst exhibiting exactly the same financial performance.

The ability of productivity accounting to quantify the wealth created (through the productivity variance) and how it is distributed (through the price recovery variance) has encouraged its use in organization-wide productivity gainsharing systems. The approach also offers opportunities for evaluation and validation of budgets and plans. This is so because, whenever budgets or plans are set for a future period, new productivity and price levels are implied *even if these did not form the basis on which the projections were made.* (For a real life application of the use of productivity accounting in planning and budgeting, consider the case study in the box below.)

Budgeting for Success: Using Productivity Accounting for Budget Reviews

The budget of an Australian fashion house displayed gratifying improvements in bottom line performance as measured by return on assets managed (ROAM). Despite a small decline in revenues, the cost and expense ratios were all improved relative to the current year's results. A productivity accounting analysis revealed that the improved profit position was driven entirely by significant growth in total productivity while the price recovery was marginally negative. This meant that the budgeted financial performance was a function of real wealth creation consistent with a competitive pricing policy - a very strong position if the assumptions underpinning the budget were robust.

There were several anomalies in the budget but two aspects in particular warranted closer inspection. Firstly, a 7 percent increase in the materials recovery was not ostensibly accompanied by any technical or other improvements to operating processes as no capital expenditures were being contemplated, no new designs requiring less material input were being introduced, nor were improvements in quality or reductions in wastage likely because 8 percent fewer people were to be employed.

Secondly, the productivity of working capital was expected to decline quite noticeably because of real increases in trade accounts receivable in the face of a drop in sales volumes. At the same time massive increases in staffing and expenditure in administration were planned. Extended collection periods together with an expanded administration beg any number of questions. All in all, the budget needed a serious rethink since the productivity targets implicit in the financial figures were implausible. If the materials productivity gains were not realized whilst the expenditures in administration were incurred, rather than improving, ROAM would deteriorate!

Throughput Costing

Eli Goldratt, originator of the *Theory of Constraints (TOC),* believes that in all (but, especially, commercial) organizations, there are fundamental measurements. The underlying premise for these measures is that the goal of the organization is to make more money now and in the future. Organizational systems are consequently viewed as 'money making machines' and the essence of throughput costing is derived from deciding what are the critical characteristics of such a system.

From this perspective three fundamental measurements are specified:

- *Throughput* or the rate at which the system generates money through sales;
- *Inventory* or all the money the system invests in purchasing things the system intends to sell; and
- *Operating expense* or all the money the system spends in turning *inventory* into *throughput.*

Throughput (T)

Throughput is defined as the sales (never production) made within a specified period of time (say, a month) less the purchased materials and the cost of outside contractors that went into those sales. Throughput approximates many definitions of value added. If money cannot be readily identified with specific items that are sold, then what has been purchased is a capability that is part of the organizational system itself.

Inventory (I)

Inventory embraces all the money spent purchasing the fixed and working capital items that remain within the organizational system. Raw material, work-in-process and finished goods inventories are all valued at the prices paid for the raw materials. Goldratt's definition does not include any of the value added to the materials, not even the cost of the labor involved, because of the distortions such a valuation introduces into the calculation of accounting profit. In this way, inventory is regarded as more of a liability than an asset and all attempts to reduce it without prejudicing throughput should be encouraged.

Operating expense (OE)

Operating expense embraces all the costs incurred over a specific period of time that are not directly related to a particular product or service. It does not distinguish between so-called direct labor (say, front line staff) and senior executives since both are conceptually doing the same task - turning inventory into throughput.

System-wide & control measures

Using the three measures defined above it is perfectly possible to calculate system-wide measures of performance such as net profit and return on investment (ROI).

Where,

Net profit (NP) = T - OE

And,

ROI = (T - OE)/I

In TOC terms, control is defined as "having knowledge of where things are versus where they are supposed to be, and who is responsible for any deviation". Deviation is seen to be of two types: things that should have been done but were not, and things that should not have been done but nevertheless were. The three control measures that are defined are *throughput dollar days, inventory dollar days* and *local operating expense.*

Throughput dollar days provides a means to track the extent to which throughput delivery promises were met. It is defined as the value of all orders (valued at selling price) multiplied by the number of days that collectively they were late. It provides a means to attach a monetary value to an occurrence that has always been viewed as problematic - late delivery of orders to customers.

Inventory dollar days is concerned with any build-up of inventories that should not have occurred. Since in TOC language inventory is seen as a liability and not an asset, any unnecessary build up is counter productive. It is defined as the value of all inventories not converted into throughput (i.e. still being held) multiplied by the number of days before shipping. Typically inventories have been quoted in value or time (we are holding finished goods worth $25 million or we have two months' supply). Inventory dollar days acknowledges the importance of both facets. On the basis of this measure the tendency will be to reduce inventories that have been carried for long periods thereby minimizing the effect on customer service levels.

The desirable level of inventory is a function of the level of demand in a period equal to the difference between the product or service lead-time and the customer tolerance time. Customer tolerance time is defined as the time from when the customer places the order to the time when delivery is expected. This may vary considerably although it is much more likely to be small when a service rather than a product is being purchased. While you might be prepared to wait two weeks for the delivery of a new car, any more than 10 minutes for a rented vehicle would cause severe irritation!

Local operating expense simply represents operating expenses over which the local area has full control. These would be expenses that are directly attributable (regardless of their nature - fixed, semi-variable or variable) and that are controlled solely by the sub-system that is incurring them.

Eli Goldratt contends that most measurements currently in use are inappropriate and that, under such circumstances, the only effective remedy is to revert to the root of the subject. The root lies in the Theory of Constraints and its application to the problem without any preconceived notions of the solution.

Economic Value Added (EVA)

The notion of EVA is that an organization creates value (for its shareholders) only if the return on its capital exceeds the opportunity cost of acquiring the capital from lenders or shareholders or the rate that investors could earn by investing in securities with similar risk profiles. In effect, it measures the extent to which the rate of return exceeds a 'hurdle' rate defined by the total (explicit plus implicit) cost of capital. Although the notion of hurdle rates has been around for many years in the practice of evaluating capital investment projects, this approach (developed by New York consulting firm, Stern Stewart) seems for the first time to have extended it to the entire organization.

EVA is calculated by deducting from the after tax operating profit a charge on the amount of capital it employs. If the resultant EVA is positive then the company is deemed to have created value over the period in question; if the EVA is negative then the company was a 'value destroyer'. Although the basic principle is straightforward, there are many delicate adjustments that need to be made to the accounting numbers for EVA to become a reliable indicator of shareholder value and correlate well with stock market prices.

Users of EVA agree that it is undoubtedly superior to traditional financial measures such as return on capital employed or earnings per share. Since EVA focuses (through the adjustments) more on cash flow, it is much more difficult to manipulate and therefore a more reliable indicator of performance. Stern Stewart also claims that EVA provides an early warning signal insofar as EVA will often turn negative long before profits begin to show a decline. (For a real life application of EVA, consider the case study in the box below.)

The EVA Brew

Although Economic Value Added (EVA) may sound simple in theory, it can be tricky to apply in practice. Stern Stewart advises clients to make anything up to 164 changes to their accounts. The following example shows how the same consultancy works out the 1996 EVA of South African Breweries (SAB), a company that owns hotels and shops as well as being one of the world's biggest brewers.

EVAluating	**1996**
South African Breweries	**R millions**
1. Economic capital = Shareholders equity	5,799
+ goodwill written off	1,521
+ capitalised cumulative unusual loss	930
+ deferred tax	405
+ minority interests	2,352
+ total debt	4,415
	15,422
2. Net operating profit after tax (NOPAT) = Operating profit	3,406
+ interest expense	689
- unusual gain	68
- taxes	978
	3,049
3. Weighted average cost of capital (WACC)	
Cost of equity	20.4%
Cost of debt	10.7%
WACC =	**17.5%**
4. EVA = NOPAT - (capital x WACC) =	
3,049 - (15,422 x 17.5%) =	**R350m**
Source: Stern Stewart	

First, Stern Stewart calculates SAB's 'economic capital' [1]. This is its equity and debt, plus adjustments for items such as cumulative goodwill associated with acquisitions. Accounting rules treat goodwill as an expense charged against profits, but Stern Stewart says that goodwill and other things such as R&D are capital investments that should produce returns in the future.

Next, Stern Stewart works out how much SAB's assets earned after tax in 1996 [2]. Then it calculates the company's cost of capital. The cost of its debt is simply the average interest rate the company pays. But what about the cost of equity? To calculate this, Stern Stewart uses the capital assets pricing model, which holds that a firm's cost of equity consists of a risk free rate of return for a stock market plus a risk premium that reflects how volatile its share price has been relative to that market. Applied to SAB, this produces a cost of equity of 20.4 percent. Because SAB has more equity than debt, its weighted cost of capital is 17.5 percent [3].

Lastly, Stern Stewart multiplies this percentage figure by SAB's capital employed to produce a capital charge, which is then deducted from the company's profit. The result shows that SAB had a positive EVA of R350m ($81m) [4]. Its shareholders no doubt raised their glasses to that.

Buy-in to EVA methodologies is often obtained by linking bonuses and other incentives to EVA results. This then puts operating and financial managers on the same wavelength and managers are less likely to build empires at shareholders' expense. EVA discourages executives from making large investments because the capital charge depresses the measure of value created. Similarly, the results can be artificially increased by dramatically cutting back on capital expenditure.

The question of applying EVA to service organizations that may not ordinarily accumulate tangible assets (like plant and machinery) has also received attention. The calculations are definitely harder when more intangible assets such as brand names or intellectual capital are involved - notwithstanding the fact that the principles remain intact. Stern Stewart has successfully completed EVA implementations in such service sector institutions as credit rating companies and telecommunications corporations, claiming that only financial institutions and very young companies are unsuitable.

EVA (along with its look-alikes) has received its fair share of criticism. Gary Hamel insists that EVA is merely a measure of capital efficiency and it reveals nothing about a company's capacity to create wealth. And, it is very unlikely that EVA would have told Bill Gates anything useful at any stage in the development of Microsoft. EVA is often viewed merely as a backward-looking measure that tells managers little about how current strategies are likely to roll out. Using the Balanced Scorecard and similar 'family of measures' approaches has been one response to these drawbacks, although EVA proponents believe that a profusion of different measures is confusing while EVA provides a clear focus.

Integrated Business Control (IBC)

IBC was developed during the 1970s and 1980s by Ken Glassby to address a need for an accurate, simplified high-level clerical work measurement system that could be linked with management control. IBC and some of its derivatives (like the Measurement of Administrative Productivity, MAP, program offered by the National Productivity Institute of South Africa) were introduced at a time when labor costs were rising and there were serious shortages of skilled clerical and administrative personnel. IBC was designed to evaluate clerical and administrative work performed in a modern office with a mix of manual and machine operations.

Ordinarily, using traditional O&M approaches, this would have constituted a work study nightmare. To overcome this impediment, IBC was based on a series of primary activities (or data blocks) that represented significant chunks of work. Each data block was specified after intensive study of clerical and administrative activities and then the results were distilled using multiple regression analysis and similar statistical techniques.

The outcome was 10 data blocks that sufficiently described every component of clerical and administrative work. The 10 data blocks were:

1. Read
2. Write
3. Copy
4. Calculate
5. Fasten
6. Find
7. Key
8. Type
9. Sort
10. File

The application of IBC is based on the premise that, wherever work is done, the time will be the same provided the method of working, quality standards and environment are the same. If the actual measured time differs, then one or more of these factors needs to be addressed. Over a control period of one day, IBC system results have been shown to be accurate to within +/- 5 percent with 95 percent confidence.

IBC clients have successfully used the technique for:

- *Manpower and capacity planning* - providing a reliable basis for planning future staff and investment requirements;
- *Systems comparisons* - comparing the cost and service effectiveness of alternative computer-based proposals;
- *Product costing* - establishing accurate costs for financial products;
- *Quality and service* - highlighting aspects to be checked to ensure meeting quality and service objectives;
- *Improving staff training* - using IBC's simple language to provide the basis for training and operations manuals;
- *Systems design and programming* - defining and quantifying data entry, output and processing requirements; and
- *Organization* - accurate evaluation of the work required to achieve cost and service objectives.

In addition to clerical and administrative environments, IBC has found application in many situations that, because of their non-repetitive nature, do not lend themselves easily to normative measurement. These have included maintenance, computer programming and vehicle repairs.

GENERAL & SPECIAL DIFFICULTIES WITH MEASURES

Five Basic Decisions

In defining productivity measures there are five decisions that may have to be taken. These decisions are:

- Deflator decision - *quantities and prices*;
- Resource variability decision;
- Attribution decision - *systems and centers*;
- Contrast decision - *actuals, budgets*; and
- Series decision - *time periods*.

Deflator decision

Since productivity measures address, by definition, products, services and resources in physical quantities or 'real' terms, the deflator decision is designed to partition monetary values into their quantity and price components. This is necessary to determine the extent to which changes in the financial position are a function of productivity or price effects. This is the essence of productivity accounting methodologies.

Variability decision

Resource variability defines how resources behave relative to changes in product or service volumes in the absence of managerial intervention. Variability *usually* ranges from 1 (completely variable) to 0 (completely fixed). Although this decision has no effect on the productivity change per se, it does allow insights into the nature of the productivity change.

Attribute decision

An attribute represents the area within the organization where resources can be directly attributed to products or services. It defines the system boundaries within which performance is determined. It can be represented by the whole organization (corporate system) or, alternatively, by a division, department, regional office or line of business. Clearly, the more partitioning of the larger system into more closely defined attributes, the more precision and insights the results may yield.

Two important issues arise, however, out of multi-attribute analysis:

- It may be necessary to define and incorporate intermediate as well as final products and services of the organization. This will entail the treatment of internal transfers.
- There may be resources that are not easily attributable to any specific product. Head office administration is an example and, in such cases, it may be necessary to specify output proxies to enable performance to be measured.

Contrast decision

As indicated earlier, all measurement is by contrast. In this context, the contrast decision means defining the *reference* and *review* periods in terms of actuals, budgets, peer organizations, standards or norms.

Series decision

Time series decisions involve defining the length of the periods to be contrasted. This could mean (say) a contrast of two sets of quarterly results or a contrast of the year 2000 annual results with the 2001 budget. These decisions are relatively straightforward, but it is important to remember that, although the length is unimportant per se, the periods being contrasted must be of comparable length.

Aggregation

One of the advantages of using financial measures is that having everything expressed in monetary terms allows for simple aggregation of products, services and resources. When units are expressed in physical terms having aggregated measures of output or resources becomes problematic. However, if the units of output and resources have prices, then price weighting can be used and the results expressed in so-called 'real' terms.

In order to aggregate a number of items that are expressed in dissimilar units, two conditions ordinarily need to be met:

- A means to render items dimensionless; and
- A set of weights.

How these conditions can be met in practice is best demonstrated by some examples. The first example concerns OMAX. When generating an overall index of performance the individual criteria being used are first rendered dimensionless by converting them to a (in this case, normative) score between 0 and 10. Then, in order to aggregate the scores, each of them is multiplied by a weight assigned by the manager of the system being measured. After that the process is simply one of arithmetic and the overall index (of 400 in the example given previously) is generated.

Similarly, the construction of an overall index of outputs and resources when using productivity accounting follows the same steps, although the means to render the items dimensionless and the weights are quite different. Productivity accounting invariably measures by contrast - most popularly by comparing performance in one period with that of another. By measuring first the changes in outputs and resources and then expressing the result as an index or ratio (properly defined as a dimensionless quotient), the first part of the aggregation exercise is complete. Then combining the indices using price weights - usually in the form of either Laspeyres or Paasche indices - completes aggregation.

Special Difficulties in Service Sector & White Collar/Knowledge Worker Situations

In surveys conducted amongst even large sophisticated organizations in the United States, defining and measuring productivity was always seen as a stumbling block to the implementation of large-scale improvement programs. This seems particularly true of white collar and so-called knowledge worker programs. The easy recognition of what constitutes output and the nature of the technology being used tend to make the specification of productivity measures in industrial and mining (blue collar) situations relatively easy.

Since clerical functions tend to be more prescribed, often machine paced and with predictable outcomes, specification of their outputs is also fairly straightforward. Techniques that measure work content such as MTM are likely to be appropriate although, even in these well-defined areas, success may depend on the degree of employee involvement. Specification of inputs is always less troublesome and is rarely a problem in either industrial or service oriented situations.

The real measurement difficulties begin with knowledge workers and they are of two distinct kinds. Firstly, it is necessary to specify the outputs, making clear distinctions between results and activities - being productive rather than just busy. Similar difficulties are encountered when the output series is discontinuous (non-repetitive activities) or when the service/product specification/design changes.

Secondly, the broader nature of the tasks being undertaken must be recognized insofar as the amount of discretion necessarily exercised by knowledge workers is concerned. Measurement practitioners must properly and actively engage knowledge workers in the construction of measures and special care must be taken to ensure that proper 'buy in' occurs. It is unlikely that measures developed independently of the knowledge worker group will be readily accepted. Since the trend worldwide is to greater concentrations of knowledge and service work (even in industrial environments), an ability to measure and manage such activities is essential.

The specification and aggregation of outputs is not usually straightforward - especially for those services where there is no direct link between the service and the payment for it because of the absence of prices that can be used as weights. This would be the case in (say) a government department where the services provided are paid for out of taxes collected by the treasury rather than by the consumer directly.

There are effective ways to specify, quantify and aggregate such products and services using a combination of sessions employing group dynamics with stakeholder groups (to distinguish between genuine outputs and mere activities) and scoring matrices (to derive weights and provide an aggregation process). The work on scoring matrices for outputs was a product of co-operative development work carried out at the Oregon Productivity Center and first presented under the banner of OUTMAX in Portland, Oregon in 1986.

In their work at the US Department of Defense, Swaim et al found only four generic types of systems that were suitable for measurement in the service sector. With one exception, all of these have been addressed in this paper. The four types were:

- *The normative productivity/performance measurement methodology* - a structured participative approach using the *nominal group technique* to develop decentralized measurement and evaluation systems;
- *The multi-criteria performance/productivity measurement technique* - also called OMAX and, later, evolving into the Balanced Scorecard;
- *The multi-factor productivity measurement model* - more usually called productivity accounting; and
- *Surrogate performance/productivity measurement approaches* - more commonly called control panels.

Finally, Ruch found six difficulties associated with the measurement of white collar/knowledge worker productivity that he summarized as follows:

1. It is difficult to define the output or contribution made by the white-collar/knowledge worker.
2. There is a tendency to measure activities rather than results.
3. It is difficult to match inputs and outputs within a time frame.
4. Quantity and quality are often inseparable and the quality of the output is even more difficult to ascertain than the quantity.
5. The distinction is not always made between efficiency and effectiveness and, in order to be productive, the white collar/knowledge worker must be both efficient and effective.
6. White collar/knowledge workers, unlike production workers, are often unaccustomed to being measured.

Using Surrogates

Surrogate quantities

Price indices can be used when it is not possible to decompose values into their quantity and price components. Applying a price index, such as the production price index, to changes in value removes the effects of price changes and the resultant constant price ratio (or value in *real* terms) represents a *surrogate* measure of quantity change.

Price indices that are typically used in productivity measurement to derive surrogate quantity changes are:

- Consumer price indices (CPIs);
- Producer (or wholesale) price indices (PPIs);
- Implicit GDP deflators; and
- Indices derived from in-company baskets.

Surrogate measures

Sometimes it is not practical or even possible to measure directly certain aspects of performance. Motivation, for example, is a critical indicator of how employees are going to behave - what their level of commitment, morale and productivity might be under a given set of circumstances. It *is* possible to measure motivation directly, but it is time consuming and expensive to do so. An often-used surrogate for motivation is the level of absenteeism and/or employee turnover.

High levels of absenteeism simply indicate employees' preference for staying at home rather than coming to work. Absenteeism responds fairly quickly to declining motivation. Turnover, on the other hand, is a longer term (albeit, more permanent) employee response to a problematic situation at work. Of course, since surrogate measures are not measuring the event directly and they are often influenced by other factors, they can be less than reliable and must be used with circumspection and with full knowledge of their limitations.

Sometimes, surrogate measures are used because the measurement of the real objectives proves difficult because (say) appropriate information is unavailable. The performance of a plant maintenance department, for example, might be measured in terms of completion time for replacing a particular component or the utilization of the maintenance crew. These are laudable in themselves but not altogether reliable indicators if the ultimate objective of the department is to maximize the uptime of the plant.

Lead indicators, such as customer relations, stock levels, staff morale, new product development, and the development of managers often provide surrogate measures of the more concrete lag indicators such as sales levels, gross profit, or market share.

CONCLUDING REMARKS - LOOKING AT MEASUREMENT & STRATEGY

No performance measuring system is static. To the extent that the system's purpose is to provide insights as to whether the organization's actions are contributing to the achievement of its strategy, measures are dependent on strategy and action. Thus, measurement, strategy and organizational action are interdependent and each will be influenced by the other. Goldratt takes a systems view when he states that "Measurement should induce the parts to do what is good for the whole".

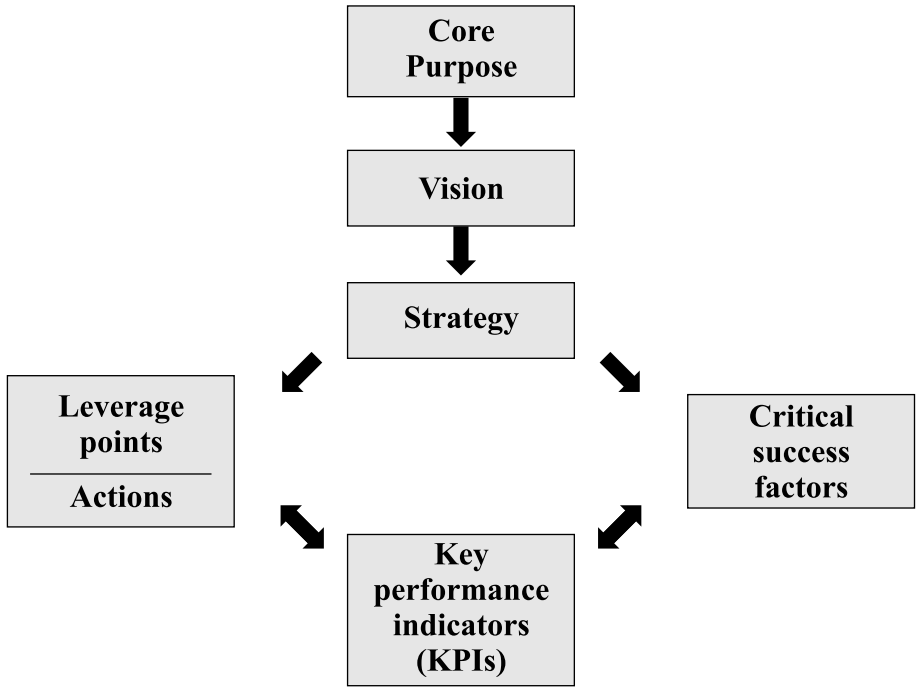
Core purpose refers to an organization's reason for existence or 'raison d'être'. It overlaps the vision but runs deeper and is more enduring. The core purpose reflects the organization's highest aspirations for greatness and achievement extending over a long time frame.

Vision refers to what an organization wants for itself within a specified time frame. It can be expressed in terms of both quantitative and qualitative results. Qualitative results would include descriptions of the work environment, organizational culture and values, and the organization's reputation with its customers.

Strategic direction embraces a broad framework for achieving the vision, including the core processes that will be employed, the areas within the current reality in which action will have disproportionate returns in terms of time and effort *(critical leverage points)* and the critical factors that will ensure success *(critical success factors)*.

The strategic direction determines the activities, inputs and outputs that are necessary and these lead to goals and targets. Once the goals and targets are set then the need arises for measures *(key performance indicators or KPIs)* to show us how well we are performing against those goals and targets. The interrelationships are as follows:

Figure 12. Visions, Strategies, Goals, & Actions



It is from the KPIs identified during the strategy formulation process that actual measures must be derived. Thus, performance measurement systems should be designed such that they are both congruent with, and supportive of, the organization's vision, strategy and goals. When implementing performance measures it is vital that they reflect the needs of managers and employees at different operational levels since a common set of measures will not work in all situations. Similarly, it is clear from the preceding narratives that no single measure can reveal everything about organizational performance. One way or another a suite of carefully selected and accepted measures that reflect key performance areas will have to be designed.

Finally, to those who feel that the sentiments expressed above constitute an unwarranted denigration of measurement, the following remark may be both fitting and salutary:

> "*To many it will always seem better to have measurable progress towards the wrong goals than unmeasurable progress towards the right ones.*" - *John Kenneth Galbraith*

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DATA TO INFORMATION, INFORMATION TO KNOWLEDGE AND KNOWLEDGE TO DECISIONS & ACTIONS

John Parsons
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INTRODUCTION

Today's turbulent business environment has created the need for integrated performance measurement systems that enable the organization to reach its goals through triggering appropriate behaviors. To be successful, measurement systems need to manage a range of both technical (or cognitive) and social (or affective) actions. Generally speaking, actions in the technical domain address the question of *What needs to be done?* whilst those in the social domain address the question of *Why should we do this?*

The specific objective of this article is to provide insights that will enable the measurement practitioner to address the social issues in a way that leads to the successful implementation of measurement systems. Success in this context is defined as above; namely, triggering those behaviors that allow an organization to reach its stated vision and goals through the transformation of data to information and information to knowledge.

The transformation of information into knowledge requires insights into, and understanding of, underlying causes and this, of course, requires perception. Perception can, therefore, be seen as the interaction of information and how individuals view the world and how it works. Value systems and mental models provide such a framework for interpretation and are informed by qualities such as previous knowledge, experience, and personality. Thus, two individuals receiving the same information would probably convert it differently and therefore their knowledge and, more importantly, their actions would be different. This exerts a powerful influence on the effectiveness of the measurement process.

Introducing a measurement system often represents something new for the people being measured. As indicated in a previous article, the broader nature of the tasks being undertaken must be recognized insofar as the amount of discretion necessarily exercised by service sector and white collar/knowledge workers is concerned. Measurement practitioners must properly and actively engage knowledge workers in the construction of measures and special care must be taken to ensure that proper 'buy in' occurs. It is unlikely that measures developed independently of the knowledge worker group will be readily accepted.

The social implications of introducing anything new have long been recognized. Machiavelli, writing in *The Prince,* expressed it with great clarity when he said: "*There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things, because the inventor has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new".*

TAKING A SYSTEMS VIEW

Increasingly, a systems view of organizations is being used to evaluate how business and government institutions work. Systems thinking evolved out of chaos theory, a body of knowledge that challenged and eventually overturned the Newtonian view of the world as a machine and replaced it with a world of infinite complexity in which everything is connected in a vast and ever-evolving web. Chaos theory saw connections between academic disciplines, between the physical and the metaphysical, and between man and nature. In business this translates into a need to see connections between internal functions, customers and suppliers, organizations and community, and companies and the ecosystem - an authentic *extended system* of stakeholders.

In his futuristic account of *The New Realities*, Peter Drucker contemplated the prospects for economic theory from a systems perspective when he stated:

> *"In any system as complex as the economy of a country, the statistically insignificant events, the events at the margin, are likely to be decisive events...By definition, they can neither be anticipated, prevented (nor)...always be identified even after they have had their impact."*

Traditional business analysis, with its preoccupation with breaking everything down into its component parts and then studying the parts, is useful when dealing with machines. In the early days of the industrial age it was possibly convenient to adopt such an approach, but such thinking will mislead, often dangerously, when applied to today's complex conditions of existence.

Mike Balle likens this so-called reductionist approach to trying to train a horse to run faster by teaching each of the legs to perform more efficiently! We know intuitively, based on all our life experiences, that it is patently absurd and it will not work. Yet we persist in managing our organizations according to the same piecemeal principles - obtain ISO certification, use the latest technique, re-tool, and the plague of quarteritis.

Systems thinking does not imply that we have to be looking at everything all the time - that there is no room for specialization. It simply means having sensitivity for how the parts connect and how changing one part can affect the functioning of the others. Sometimes this means nothing more than asking the right questions. If we are treating an elephant (the *organizational system*) for a condition of the trunk (a *sub-system* or *functional department*) we must be careful at the end of the exercise to ask "How does the elephant feel?" rather than merely asking "How does the trunk feel?"

Moreover, systems have some powerful properties. For instance, systems have their own goals and, usually, no matter how hard we push, the system seems to push back harder. Peter Senge puts it this way: *"When placed in the same system, people, however different, tend to produce similar results"*. This easily nurtures a victim mentality, a feeling that the enemy is out there, that stifles any sort of productive action. Under such conditions, unraveling the dynamics that influence system behavior becomes a critical step in ensuring survival in the future.

There have been significant investments in information technology, measurement techniques and other interventions worldwide that appear to have had imperceptible impacts on measured organization performance. This measurement paradox may have arisen for one or two reasons:

- The interventions are not linked to an overall strategy for improvement and therefore are unsuccessful; and/or
- The measurement systems used are not tracking the outcomes and therefore fail to detect any improvement that may be occurring.

Senge, Deming, Goldratt, Weisbord, Beck and others have repeatedly emphasized the need to think *systemically* about organizational performance improvement. Attempts to improve, in isolation, separate parts (or *sub-systems)* within an organization do not necessarily lead to overall performance improvement for the organization. Actions must be linked to a carefully orchestrated strategy and the organization's measurement system needs to track those actions to ensure that their effects are indeed having the desired impact on organizational performance.

To escape the paradox, improvement interventions and measurement systems need to be designed and implemented within the context of an overall strategy for improvement. The outcomes (effects) of the interventions on the system must be predicted and the measures designed to track their impact on total organizational performance.

SOCIAL AND TECHNICAL SUB-SYSTEMS

An overview of productivity's social-technical processes as they affect measurement is given in the box below:

Figure 1. The Interaction of Social and Technical Sub-systems in the Design of Measurement Systems

Social sub-systems are concerned with:

- The affective domain where change occurs
- Involving people (stakeholders) in both the design and the functioning of measurement systems
- Using dynamic group processes to engage people in the development and deployment of measurement systems that support organizational vision and strategy
- Assembling an extended system of stakeholders that includes representation from management, employees, unions, customers, suppliers, owners

Technical sub-systems are concerned with:

- The cognitive domain where thinking and judgement occur
- Generating a *scoring matrix, balanced scorecard* or *control panel* of performance indicators that are representative of the complex array of strategic actions taking place
- Designing measurement systems and specifying, collecting and processing data to information and information to knowledge

The purpose of addressing the social sub-system is to:

- Get all-round vision from a stakeholder perspective
- Ensure buy-in from those being measured so that they respond to the measurement signal
- Alert users to the effect of perceptions on the interpretation of results.

The purpose of addressing the technical sub-system is to:

- Get all-round vision from a measurement perspective (efficiency, effectiveness, utilization, productivity, profitability, QWL)
- Ensure that the measures, actions and strategy and vision are aligned.

Generally speaking, actions in the affective domain address the question of 'Why should we do this?'

Generally speaking, actions in the cognitive domain address the question of 'What needs to be done?'

Getting the Technical Aspects Right

In 1992, Kaplan and Norton published in Harvard Business Review the results of a year's research work on performance measurement. In response to the need to remedy the inadequacies of traditional financial measures, they devised what they called a *balanced scorecard* of financial and operating indicators. In the process, they helped defuse the perennial battle between accounting, engineering and operating staff over who had the 'right' measures. Since the scorecard is designed to track the key elements of corporate strategy, reliance on one facet could be fatal. A 'family of measures' is clearly needed.

The notion of integrating financial, operating and other indicators into a balanced 'cockpit' of measures precedes by a decade the research of Kaplan and Norton. The *Objectives Matrix*, or *OMAX*, was designed as a group-based measurement, goal setting and motivational tool of particular (but, by no means, exclusive) use in white collar situations - especially those that are less amenable to more traditional measurement approaches.

Developed in the early 1980s by James Riggs whilst at the Oregon Productivity Center, it has been eminently successful and has found application in a very wide range of situations and in many countries around the world. Although it had its origins in service situations, *OMAX* satisfies all the requirements of a *balanced scorecard* with the additional bonus that it offers a means to combine the individual 'dials' into a composite measure of overall progress.

Whereas *OMAX* uses a *balanced scorecard* approach, *productivity accounting* tends to be more robust, unambiguous and rigorously locked into the accounting system. Furthermore, regardless of the financial and management accounting systems being used, without the benefit of *productivity accounting* it is impossible to distinguish the separate contributions that productivity (wealth creation) and price recovery (wealth distribution) are making to bottom line financial performance. More than a question of sophistication, *productivity accounting* represents a fundamental difference in how you understand the origins of organizational performance and therefore how you manage to improve it.

However, in common with *OMAX*, *productivity accounting* also produces a single bottom line score and, of course, there is nothing to prevent that score appearing as one of the measures on the *balanced scorecard* or matrix! *OMAX* generates an index of overall progress towards an array of goals, whilst *productivity accounting* generates a total factor productivity index and shows directly the contribution that productivity and price recovery are making to the financial position of the organization.

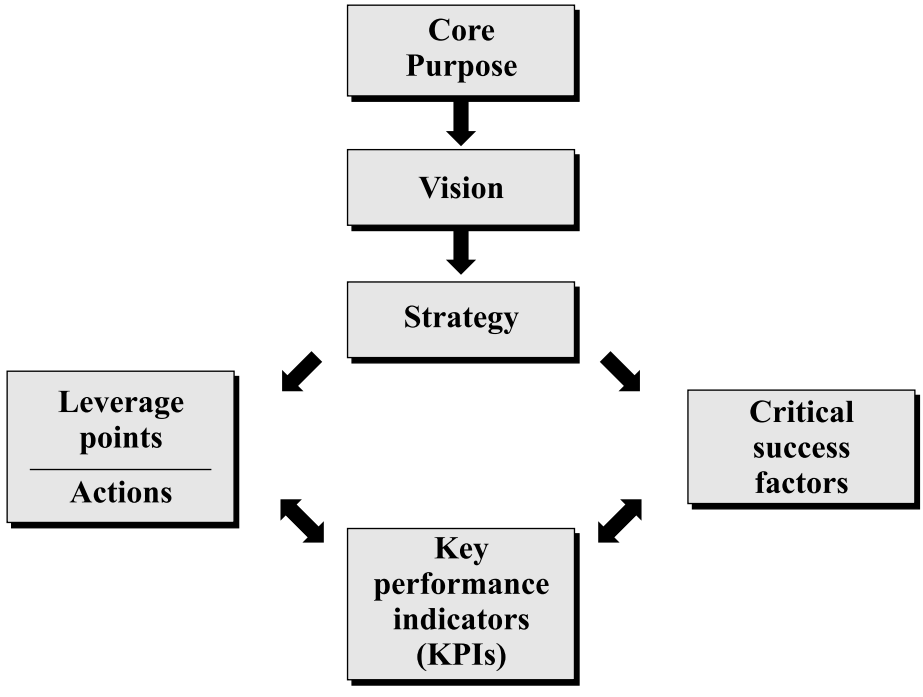
Taking a strategic direction

Strategic direction embraces a broad framework for achieving the vision and this includes:

- Core processes that will be employed;
- Areas within the current reality in which action will have disproportionate returns in terms of time and effort (critical leverage points); and
- Critical factors that will ensure success *(critical success factors)*.

The strategic direction then determines the activities, inputs and outputs that are necessary and these lead to goals and targets. Once the goals and targets are set then the need arises for measures *(key performance indicators or KPIs)* to show us how well we are performing against those goals and targets. The interrelationships are as follows:

Figure 2. Visions, Strategies, Goals and Actions



The terms used in Figure 2 are defined as follows:

- *Core purpose* refers to an organization's reason for existence or 'raison d'être'. It overlaps the vision but runs deeper and is more enduring. The core purpose reflects the organization's highest aspirations for greatness and achievement extending over a long time frame.
- *Vision* refers to what an organization wants for itself within a specified time frame. It can be expressed in terms of both quantitative and qualitative results. Qualitative results would include descriptions of the work environment, organizational culture and values, and the organization's reputation with its customers.
- A *critical success factor (CSF)* or *key performance area (KPA)* is one of a few areas where 'things must go right' for a business to flourish (Rockart) or an area of significant activity which drives performance (Productivity & Standards Board of Singapore). Generally, *KPAs* refer to specific areas of organizational functioning that have a profound impact on performance and are, therefore, worthy of significant managerial attention if the vision, goals and objectives of the organization are to be met.
- A *key performance indicator (KPI)* is
  - A well-defined, specific measure that is derived from productivity and quality improvement efforts - numerical measures of performance (Virginia Productivity & Quality Center)
  - A yardstick by which organizations can evaluate achievement of goals and objectives and which provides the foundation of the measurement system (Botswana National Productivity Centre).

KPIs answer the specific question “How will we know whether a specific goal or objective has been reached or what progress has been made?” and will, therefore, be precisely (although, not necessarily objectively) defined and represented by a metric of some sort that is quantifiable and thus measurable.

Visible measurement & management systems

Visible measurement and management systems (VMSs) represent a direct attempt to track the progress of action plans and their impact on organizational performance - specifically in the *study* phase of the Plan, Do, Study Act (PDSA) cycle. Managers and other users utilize the information from the *VMS* in the *act* phase of the cycle. The Virginia Quality & Productivity Center developed such systems to support, inter alia, large-scale organizational transformation. The measurement results are displayed on visibility boards - or control panels - which function at various levels within the organization - strategic, divisional, and functional.

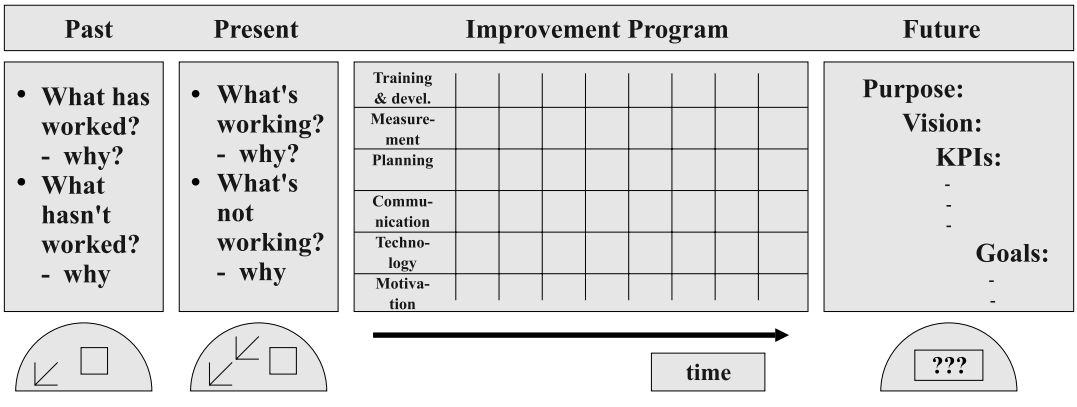
A VMS is likely to embrace:

- Measures of productivity (efficiency, effectiveness and utilization), quality, financial performance, quality of worklife and innovation;
- Individual, group, organization, and extended system measures;
- A blend of quantitative and qualitative indicators;
- An appropriate reporting frequency to the right audience;
- The application of statistical variation; and
- A balance of regular information sharing (for awareness, planning and control) and improvement (for diagnosis, evaluation and goal setting).

Balancing information sharing with problem solving is achieved through the use of visibility boards and chartbooks to portray key performance indicators (KPIs) over time. The information from these displays lends itself to further analysis to uncover underlying (root) causes and modification of the behaviors that created them. Control panels and chartbooks usually display within them an Objectives Matrix, a Balanced Scorecard or similar ‘family of measures’.

A typical VMS is shown in the Figure 3.

Figure 3. Visible Measurement System



Getting the Social Aspects Right

There are guidelines for successfully negotiating the buy-in and commitment of a larger group to any new way of doing things. Invariably, extensive consultation with stakeholders within the extended system is required. This means all the stakeholders represented within the extended system - management, employees (organized or not), suppliers, customers, board representatives and, possibly, community representatives - need to be meaningfully engaged if all-round vision is to be achieved. At certain stages, groups will need to be brought together to generate or review the suite of measures that will constitute the Balanced Scorecard, *OMAX* or VMS. At that time the following three guidelines should help ensure ownership and commitment to action:

1. *Get the system in the room.* This will probably require a combination of some cross-functional and external stakeholder representation with some representation based on specific skills and knowledge that will inform and direct the exchanges in a more objective manner. It might also include reviews of the organization in terms of its value chain, organizational readiness for change, prevailing value systems and other elements of the current reality. The goal here is not just having the whole system represented, it is also having that perspective *shared* by all the stakeholders.
2. *Use a professional process facilitator - but with a difference!* The facilitator must have sufficient awareness of the current reality and how the organization functions, otherwise he/she could easily become a pawn in the hands of the few who do. This actually makes the facilitator's role larger than merely having responsibility for the process. To be successful he/she must become more of a catalyst - prepared to influence both process and content. Unfortunately, all too often a process of ignorance swapping is elegantly facilitated, with predictable results.
3. *Have knowledge/skills in:*

    - *business/organizational functioning*
    - *group dynamics/consensus seeking techniques*
    - *measurement processes.*

    Knowledge and skills regarding the functioning of the business or organization under review can also be obtained by interviews beforehand with managers, leaders, and other stakeholders and through scrutiny of actual information and performance results. There is no substitute for data although having people with knowledge of the business in the room does help.

    Consensus seeking approaches would include the nominal group technique and even future search conferences. They must have the ability to prioritize without losing sight of the overall goals, i.e. not be *too* clinical and mathematical.

    Knowledge of measurement and performance management enables the facilitator to follow the train of thought from strategy through key performance indicators to metrics and thereby ensure consistency. Too often, unwary practitioners jump from what needs to be tracked (say, customer satisfaction) to precisely how it is to be measured. This can often occur because the data for the chosen measure ostensibly already exists in the system.

    At the end, the group *must* emerge feeling committed to action and accepting accountability for this. At least one member should regard him/herself as the champion of the movement. Anything less will seriously jeopardize success. Energy is vital.

As indicated earlier, the transformation of information into knowledge requires insights into, and understanding of, underlying causes and this, of course, calls for perception. Thus, two individuals receiving the same information would probably convert it differently and therefore their knowledge and, more importantly, their actions would be different. It is at this stage that the interaction between the social and technical sub-systems has the most profound impact on managerial decisions and actions and thereby the performance of the larger organizational system.

The shift from information to knowledge is an interpretative process that passes through the filter of an individual's value system - mindset or window on the world. The data to knowledge model used to support an integrative approach to performance measurement relies on the measurement sub-system to capture data (facts, observations) relevant to the processes being monitored and then portray the results as information. Information would in this context embrace answers to questions and provide the basis for asking different questions and it usually requires some processing of data and some comparative data points.

The Psychological Map is a very effective method of portraying the repertoire of value systems that each individual has (types in people not types of people). The Map is described as a model of mature adult biopsychosocial behavior and it will explain very clearly, inter alia, why different individuals will translate the same information into 'different' knowledge. (See the box below for an overview of value systems and the application of the Psychological Map.)

Thus, the Map could easily be used as a means of predicting how different managers will react to the output of a measurement/information system based on the idea that knowledge resides in people's heads. It makes such obvious and eminent sense. As indicated earlier, it is at this stage that the interaction between the social and technical sub-systems occurs. How managers perceive and interpret what emerges from the measurement system has the most profound impact on their decisions and actions and thus on the productivity and performance of the larger organizational system.

Value Systems & the Psychological Map

Our mental models of what can and cannot be done in organisations are usually so deeply entrenched - buried within a 'pyramid of beliefs' - that we are unaware of their existence. Sometimes, what someone says or does disturbs us and we simply cannot articulate why this is so. The words or actions have, without us knowing, impinged upon one of our mental models - our tapes of how things are or should be - and we are only aware of a sense of disquiet. *What is certain is that, unless we adjust our mental models, we cannot learn and we cannot change*. And, because we are usually so confident in our thinking, we need to make our mental models explicit, thereby providing opportunities to share and discuss them with others working or otherwise involved with us.

Mental models are formed when data we capture about the world is processed through what Don Beck has described as our value systems. Value systems constitute a framework for thinking about, seeing and interpreting the world around us. They determine how we think rather than what we think about or what we value, or how well we do it.

Each system will have motivations, ethics, learning styles, and conceptions appropriate to that state. A value system is thus a container for ideas - it delimits the contents both in terms of quantity and character. Individual value systems offer no insights as to 'good' or 'bad', or 'intelligent' or 'stupid'. Good, bad, bright and stupid individuals exist in every value system. There are, however, healthy and unhealthy manifestations that profoundly affect behavior.

People's value systems change largely because of pressures of existence. As existence problems (economic, social and political) change, the brain develops coping systems to deal with the new situation. Value systems change reluctantly and slowly and they certainly cannot be changed - a warning that would-be change consultants and managers should heed to their advantage! Research over the last 20 years indicates that the progress of individuals or groups through the various psychological states can be tracked using Beck's Psychological Map™. The Map is based on the principle that, as mankind becomes increasingly sophisticated, so the problems become increasingly more complex and intricate. Each of us is likely to have a repertoire of value systems depending on the prevailing circumstances and so the coping systems represent types in and not types of people - not surprising considering there are five billion different types of people!

The Psychological Map™ offers an organic, open-ended, view of the development of human values and organisational cultures. Each of the eight value systems listed below has a basic concern - the goal that each system is seeking - which can be survival, security, action, stability, achievement, harmony, flexibility, or global order. Profiling the repertoire of values and worldviews that exist in any organisation provides matchless insights as to how people should be managed, how they learn, communicate, interpret information, prefer to be rewarded and relate to co-workers. If the white-waters world in which a particular organisation functioned required a customer-focused, flexible, and cavalier culture, there would still be room for more inwardly focused, orderly, and risk-averse, no-nonsense individuals in the pay office and quality control!

Value System	Colour	Focus	Basic Concerns
SurvivalSense	Beige	*Elite*	Survival
KinSpirits	Purple	*Collective*	Safety & Security
PowerGods	Red	*Elite*	Power & Action
TruthForce	Blue	*Collective*	Meaning & Stability
StriveDrive	Orange	*Elite*	Achievement & Autonomy
HumanBond	Green	*Collective*	Harmony & Equality
FlexFlow	Yellow	*Elite*	Flexibility & Life Quality
GlobalView	Turquoise	*Collective*	Global Order & Renewal

The Psychological Map™: A Living Systems Paradigm

MEASUREMENT SYSTEM DESIGN & CONSTRUCTION

As already discussed, a major role of a measurement system is to provide insights into cause and effect relationships. From the PDSA cycle it is clear that managerial action designed to improve performance by impacting on the extended system is not possible without knowledge of the causes of changes in the system. So, when designing and implementing a measurement system certain fundamentals have to be borne in mind. Measurement is a way to determine if you have reached your objectives - otherwise, how will you know if you are getting better? It also offers understanding about the path that needs to be traversed and the results can be used to solve problems and capture opportunities.

Basic Attitudes

In designing and implementing a performance measurement system there are some basic attitudes that are necessary. Without them it is unlikely that any measurement practitioner will succeed in producing a system that will result in improved performance. These are:

- You need to understand the nature of the phenomena being measured;
- You need to understand why these processes are being measured;
- You need to know who will use the results and how they will use them;
- You have to see measurement in the context of the overall, perhaps extended, system under review;
- You must be willing to inject sufficient energy to keep the measurement system viable;
- You have to understand and manage differences in measurement systems for awareness, control, and improvement;
- You will need to foster a critical mass of measurement expertise to ensure the organization acquires profound knowledge;
- You will need to craft a hierarchy of measures for the entire organizational system;
- You have to accept ambiguity, imprecision, ragged edges, and imperfection;
- You will need to blend objective with subjective, qualitative with quantitative, rational with irrational, analogue with digital, hard with soft, and intuitive with explicit; and
- You must ensure that strategy, measurement and action are integrated.

From the above checklist it is obvious that successful implementation of a measurement system is much more than simply getting a new tool, technique or software package. So many attempts have ratcheted through the process of acquiring the latest fad, 'selling' it to the organization, and installing it without gaining the commitment and support of the users. After a year or two, everybody has forgotten about it and someone else picks up a new package and the process starts all over again.

Design & Implementation Perspectives

The following ten measurement system design steps provide some guidance on an appropriate design and implementation procedure:

Step 1 - Assemble a multidisciplinary team. The purpose of assembling a multidisciplinary and, preferably, a cross-functional team to undertake the assignment is to have representatives from the 'whole system' in the room, who collectively possess profound knowledge, and to permit delegation of the various tasks needing to be done.

Step 2 - Conduct an input/output analysis. This requires a complete review of the system or sub-system for which measures are required. It requires a number of very specific tasks to be conducted - all of which are associated with the extended system notion. Specifically, this will entail listing:

- Stakeholders - customers, clients, internal customers, suppliers, designers, owners and community stakeholders
- Products and services produced and offered to the market
- Production/value adding processes
- Resources purchased or acquired.

Step 3 - Define user needs. This requires conducting searching interviews with key stakeholders and internal users of the system. The external stakeholders will give precious clues as to what is really important to them and the internal users will provide guidelines as to how this information might be assembled and portrayed in a way that will facilitate appropriate action.
Step 4 - Analyze the current measurement system. This entails describing in some detail what the current system looks like and how it functions. Use can be made of the various measurement criteria, measurement hierarchies and the links into organizational strategies.
Step 5 - Review the information gap. By analyzing the difference between what information the current system produces and what is desired in terms of the steps above, it is possible to decide whether to modify the existing system or to start all over again with a complete redesign.
Step 6 - Review strategies, actions & measures. The measurement system will need to lock into whatever strategic or tactical action plans have been formulated within the system or sub-system under review and within the wider organizational and extended systems.
Step 7 - Design & implement the system. The actual measures (metrics) that will make up the measurement system need to be unambiguously specified along with their data sources. Also, issues such as the eight different performance criteria, portrayal mechanisms, reporting frequency and the use of statistics will need to be addressed.
Step 8 - System review & debug. Once implementation is complete and the first round of measurement results has been produced, it will be obvious that some aspects have worked better than others. Also, the quality and availability of the raw data will be clearly revealed. The availability of good data is an abiding issue that frequently dictates the pace at which the measurement system can proceed.
Step 9 - Stabilize. Measurement systems are not working until the people for whom they were designed habitually use them. Until such times as the chief executive refuses to start his executive committee meeting without the benefit of the results of the measurement system, the system has not become habit forming.
Step 10 - Continually refine & improve. With the benefit of feedback from users, opportunities for enhancements will be constantly offered. This may entail the introduction of better techniques, enhanced portrayal and presentation, better translation of information into knowledge, or more comprehensive statistical analysis.

Conditions for Re-entry

After any off-site learning experience participants face the prospect of 'going back into the system'. Everyone has to decide whether they are committed to making the necessary effort and freeing the resources required to design, implement and maintain an effective performance measurement system. Very few people back in the organization will be naturally motivated to install a system that might well identify shortcomings in their own performance. When putting together a multidisciplinary team it is important to look for three characteristics. The first is competence, the second is influence and the last is energy. Only energy is an absolute must - so it is better to recruit volunteers rather than pressing people reluctantly into service.

It is worth identifying a group responsible for a particular area or sub-system of the business operations that is enthusiastic about the implementation of a measurement system. The group's efforts will provide a concrete example to the rest of the organization of how such a system can benefit performance rather than merely increasing the level of managerial control. Remember that it is a means to an end - to craft an organizational measurement system that supports vision, strategy and goals - rather than an end in itself. It is vital that the total system stays in focus and that the KPIs and the performance goals are revisited at least once a year to ensure relevancy.

When implementing performance measures, the needs of managers and employees at different operational levels must be reflected since a common set of measures will not work in all situations. Similarly, it is clear that no single measure can reveal everything about organizational performance. One way or another a scorecard of carefully selected and accepted measures that reflect key performance areas will have to be designed.

Time needs to be taken to educate executives and managers in the basics of statistical thinking to avoid 'knee-jerk' responses to measurement results and the importance of good data should never be underestimated - what you put in is what you get out! And, finally, to ensure that the effort will not falter because of inevitable setbacks, having identified a champion to spearhead the initiative, a sponsor (someone with considerable influence within the organization) must be recruited who will back up the champion and free resources. Outside assistance can be sought but the champion must avoid letting the initiative slip into the hands of a consultant or 'expert'. Without internal acceptance and competence no lasting improvements will eventuate.

A viable measurement system is not a 'quick fix'. Overnight success is unlikely. Old habits die hard and introducing strategic measures means a culture shift for most organizations. It takes considerable time for people to change their values and attitudes since it has taken many years to generate the ones they presently hold. A well-designed system will provide the necessary cues to those responsible for decision making and action. Make sure they have 360 degree 'all round' vision!

CONCLUDING REMARKS

Many designers, practitioners and consultants in the field of performance measurement systems have strong technical/quantitative backgrounds, often coming out of the financial and engineering fields. Although both natural and desirable, this tends to introduce a cognitive bias into the design process. However, because of the holistic nature of the beast we call productivity, attention to both cognitive and affective domains is absolutely necessary if the measurement system is to get people to act in such a way that improvement occurs. Without the social perspective, there exists the constant danger that we will be seduced by our own technical brilliance and produce an elegant measurement system that nobody uses.

Nevertheless, experiences with the old-style, punitive, control-oriented measurement systems (however unpleasant) have not all been wasted. In that huge volume of dirty bath water there lurks a baby. We should be careful not to throw it out simply because of its original owner's neglect of human dignity. It is true that change takes place in the *affective domain,* of feeling, engagement, participation and enthusiasm. But implementation and action take place in the *cognitive domain* of thinking, judging and willing.

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PRODUCTIVITY MEASUREMENT: MACRO AND MICRO LINKAGES

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INTRODUCTION

The importance of productivity has been articulated many times and in many ways. For example, Professor Michael Porter of the Harvard Business School said in his book *The Competitive Advantage of Nations* that: "The only meaningful concept of competitiveness at national level is national productivity." This theme was echoed by the Ministry of International Trade and Industry Commission on Industrial Productivity in the opening sentence of its report entitled *Made in America - Regarding the Productivity Edge*: "To live well, a nation must produce well." Taking this down to the micro level, the Secretary-General of the APO has said: "Firstly and perhaps fundamentally, there must be total commitment to productivity endeavor at the enterprise level."

At the macro and industry level, there is a need to constantly review the adequacy of infrastructure and the development potential of the various industries, as well as to identify systematic programs for technology and skills upgrading and management improvement. At the sociocultural level, constant efforts are needed to inculcate a more positive attitude toward productivity.

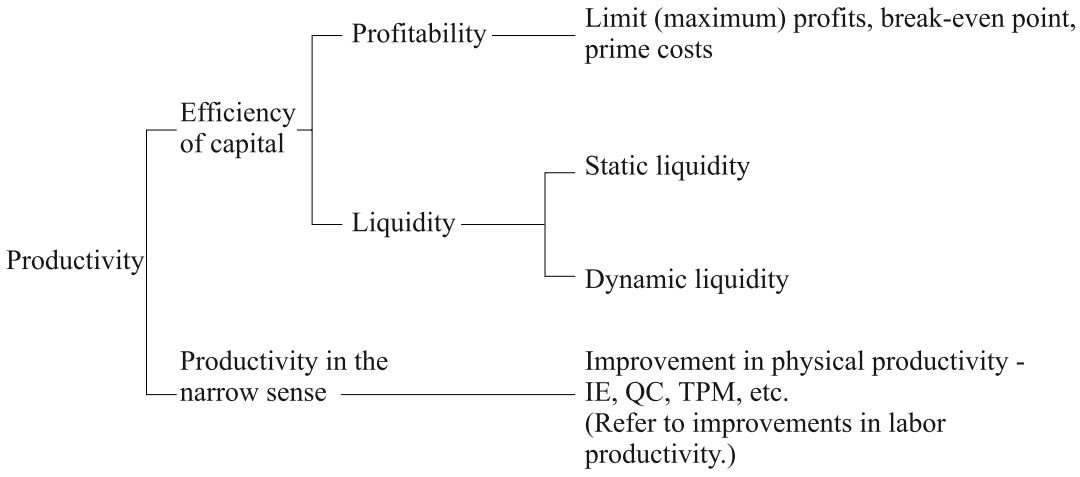
PRODUCTIVITY AT NATIONAL AND ENTERPRISE LEVEL

From the standpoint of the national economy, improving productivity means increasing value-added - in other words, increasing national income and assuring its fair distribution. Consequently, projects designed to improve productivity are clearly of national interest. In translating such projects into actions embraced by the companies whose role is to generate value-added worth through their production activities, it has to be realized that productivity improvement is also linked to an improvement in corporate profitability. This provides the means to permit increases in wages for employees.

The Nature of a Company

If we consider corporate activities from a macroeconomic viewpoint, we can define a company as an organization of production elements. The elements of production are labor and capital (this includes land, which is the tangible or materialized form of capital), and it is essential that the providers of these two elements of production should co-operate on the basis of equality. (Refer to the calculation of the results of economic activities and redistribution of value-added worth.)

If, on the other hand, we consider corporate activities from a microeconomic viewpoint, we can define the company as an organization of capital that procures capital (funds) which it then employs in an effort to grow the capital it has procured. Consequently, we can analyze productivity in the following manner with the realization that there is a constant need to improve and upgrade it.



THE IMPORTANCE OF PRODUCTIVITY

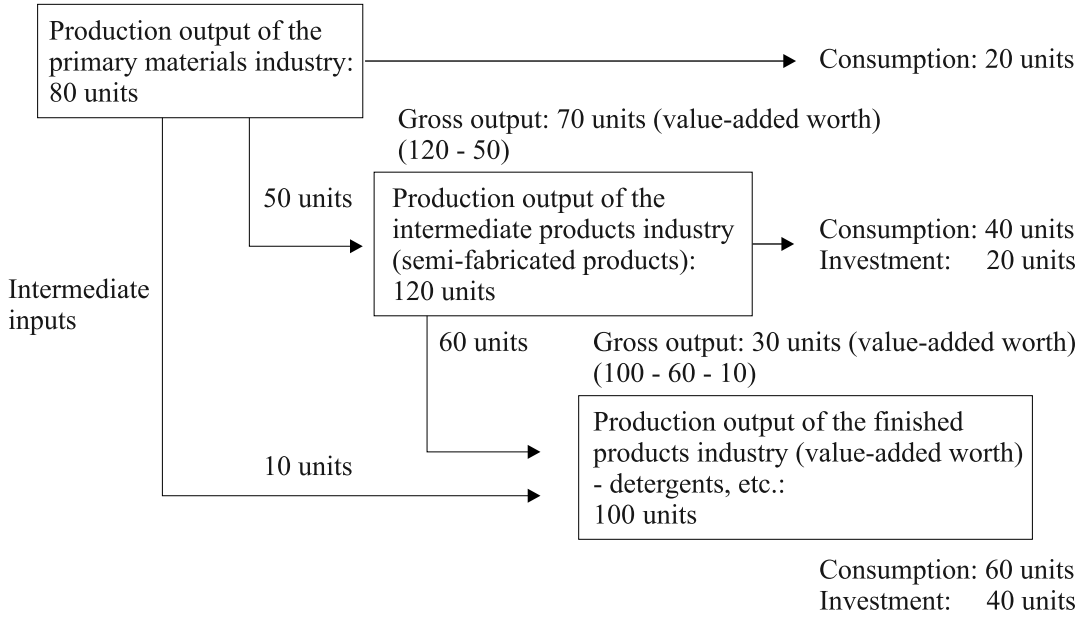
As stated earlier, projects designed to improve productivity are national issues. Apart from being of national interest, the promotion of productivity improvement is also of the greatest importance as a movement. While methods of promoting productivity vary in accordance with national circumstances, the approach must always be to proceed on the basis of clearly defined goals.

In terms of the analysis of productivity, attention should be drawn to the following points:

1. A clear definition of the problem area is essential - problems such as a low level of productivity, a high break-even point, or poor liquidity are the types of phenomena that show up in financial statements. To understand these problems more fully, management needs to look at the realities behind the figures. This takes more than just analyzing the financial statements in the company's offices. Rather, it is essential to take a look at the production site itself and listen to shopfloor opinion.
2. By using the analytical methods available, the company should be able to make proposals and give useful guidance regarding the pursuit of profit improvement and provide profit management plans. It is not enough to analyze and evaluate and to know what and where the problems are. The essential issue concerns the question of what profit plans should best be adopted by the company in the future and what steps should be implemented. Company profitability will not improve unless such issues are spelt out in proposals and followed up through guidance and support.
3. It is necessary to have helpful proposals and useful guidance on corporate capital plans and capital management. In the area of capital management, profit is the most important source of capital. Consequently, guidance on capital requires an analytical mind that is capable of forming a clear perception of the organic relationship that exists between profit management and capital management - in other words, between revenues/profits and investment.
4. The company must have the capability to correctly support all forms of strategic decision-making, including equipment investment planning.

Calculating the Results of Economic Activities

Gross output: 80 units (value-added worth)



The primary materials industry (coal, petroleum, etc.) produces 80 units. Out of this total, 50 and 10 units are used as intermediate inputs (energy or industrial raw materials) by the semi-fabricated products and the finished products industries respectively. The remaining 20 units are directly consumed by private households (as energy for heating, etc.)

The 50 units of energy or raw materials taken up by the intermediate products (semi-fabricated products) industry from the primary materials sector are the basis on which 120 units of products (plastics, light oil/kerosene, or gasoline, etc.) are produced, while 60 units are used as intermediate inputs for the finished products industry. The remaining 60 units are used for consumption (or investment). The finished products industry uses 10 units from the primary materials sector and 60 units from the intermediate products (semi-fabricated products) sector as its raw materials to produce 100 units of products, with 60 units of the products being used for consumption and 40 units for investment.

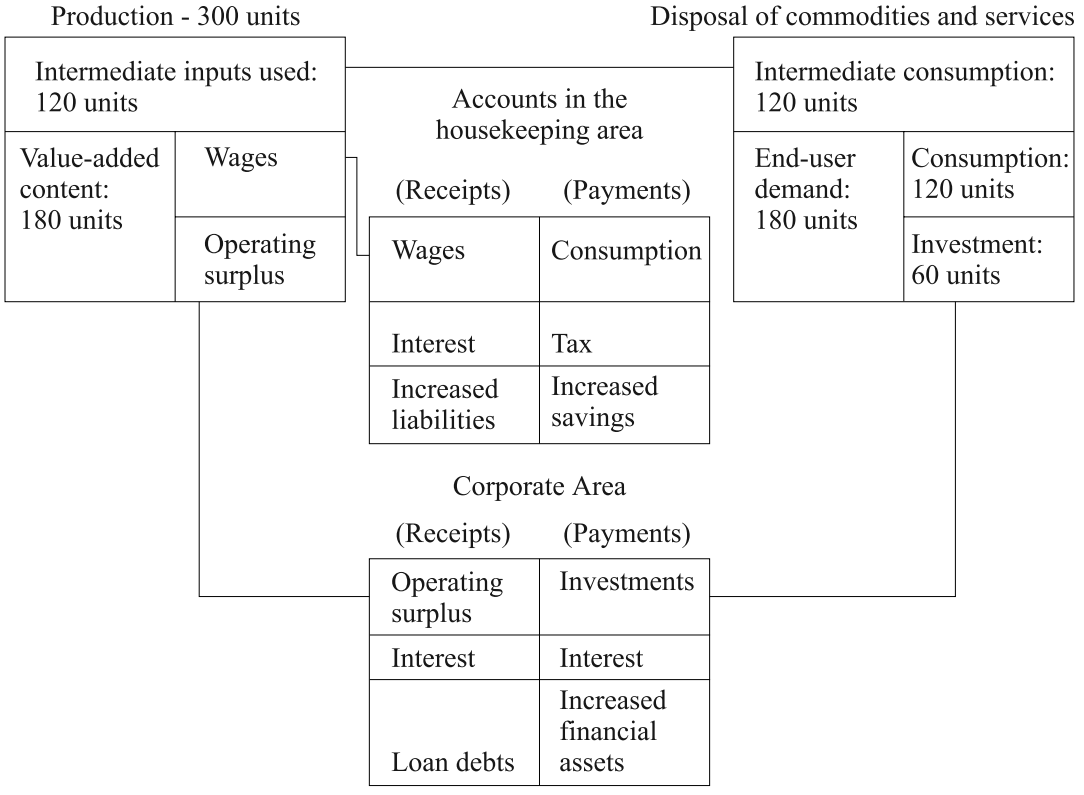
The relationship that holds between production and value-added worth (total production) as well as the final consumption in this economy is as follows:

Production (300) = Primary materials sector (80) + intermediate products sector (120) + finished products sector (100)

Value-added worth (180) = Primary materials sector (80) + intermediate products sector (70) + finished products sector (30)

End-user demand (180) = Consumption (120) + investment (60)

Redistribution of the Value-Added Worth



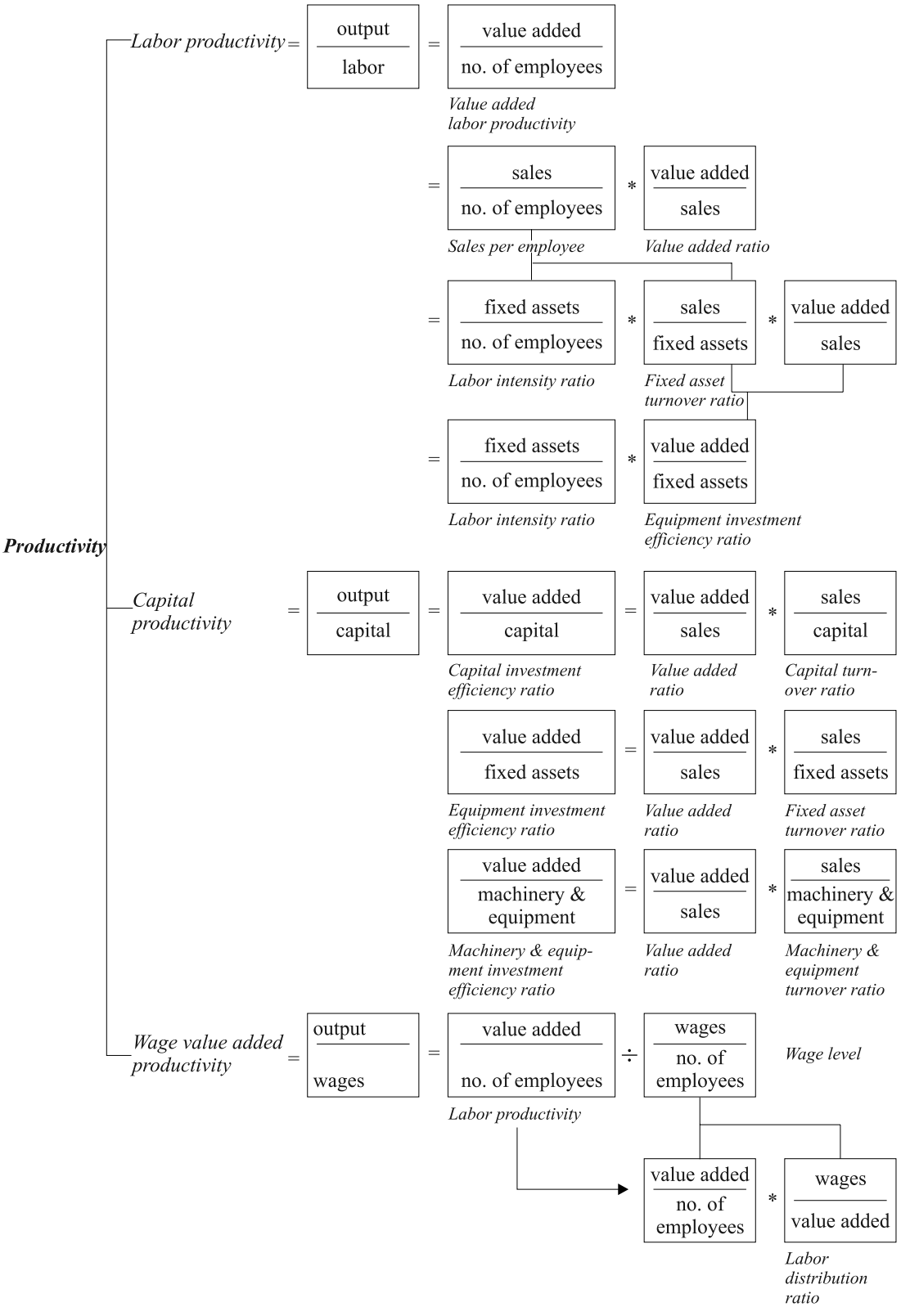
The value-added worth generated in the production stage is distributed as wages (compensation to labor) and annual consumption of operating capital (fixed asset depreciation), with profits as the remaining balance (business or operating surplus). The value-added worth is shown in the accounts of the economic entity concerned on the income (revenue) side of the Revenue and Expenditure Account.

In the housekeeping domain, the general practice is to meet the household expenses or costs from the basic income, which consists of the wage income and any interest earned on assets. Though not shown in the figure, households will spend excess funds by investing in property, by saving the remaining money or acquiring bonds or similar investments. When the household lacks funds, loans may be taken out from a bank or other financial institution. In the case of a company, the basic income is the profit (operating surplus) derived from the company's production activities. Out of this income, the company pays interest on loan funds and spends money on investments. Any financial excess or shortfall encountered in connection with these activities shows up in the accounts as an increase or decrease in the company's financial assets or liabilities. After totaling up all the transactions, both the receipts and the payments among the economic entities - including the payment of interest and taxes, consumption and investment activities, and the increase or decrease in the financial asset balances, the interest transactions and financial transactions - will show absolute equality. This must be so because international trade transactions are not taken into consideration.

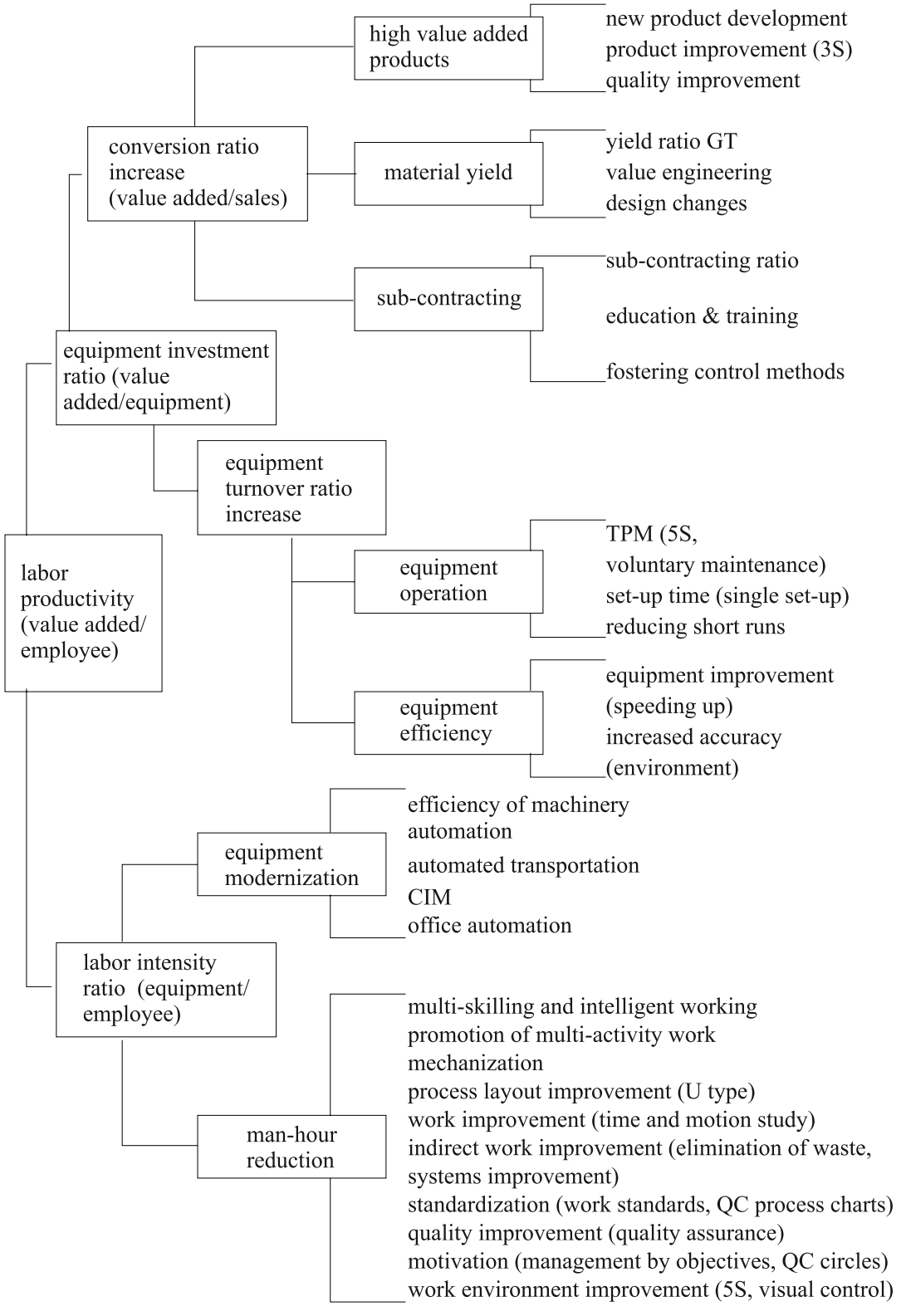
"The records of economic activities can be broadly divided into the following four areas: (1) Production of goods, investment and activities that generate value-added worth (income); (2) Activities involving the redistribution of the generated value-added worth through the various types of transfers/transactions; (3) Consumption and investment activities; and (4) The various financial activities that support these transactions."

The National Economic Accounts

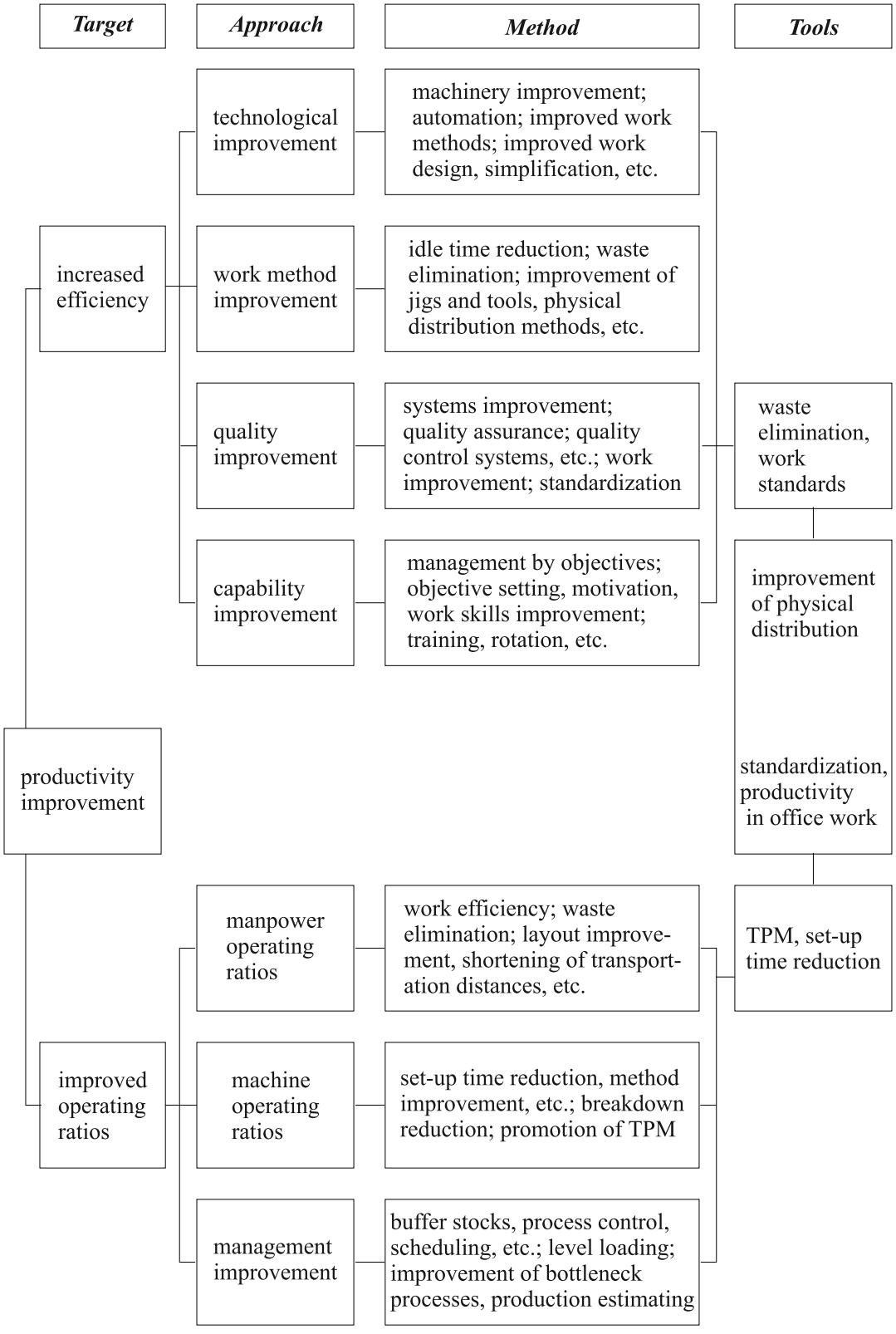
Value Added Productivity Measurement Indices



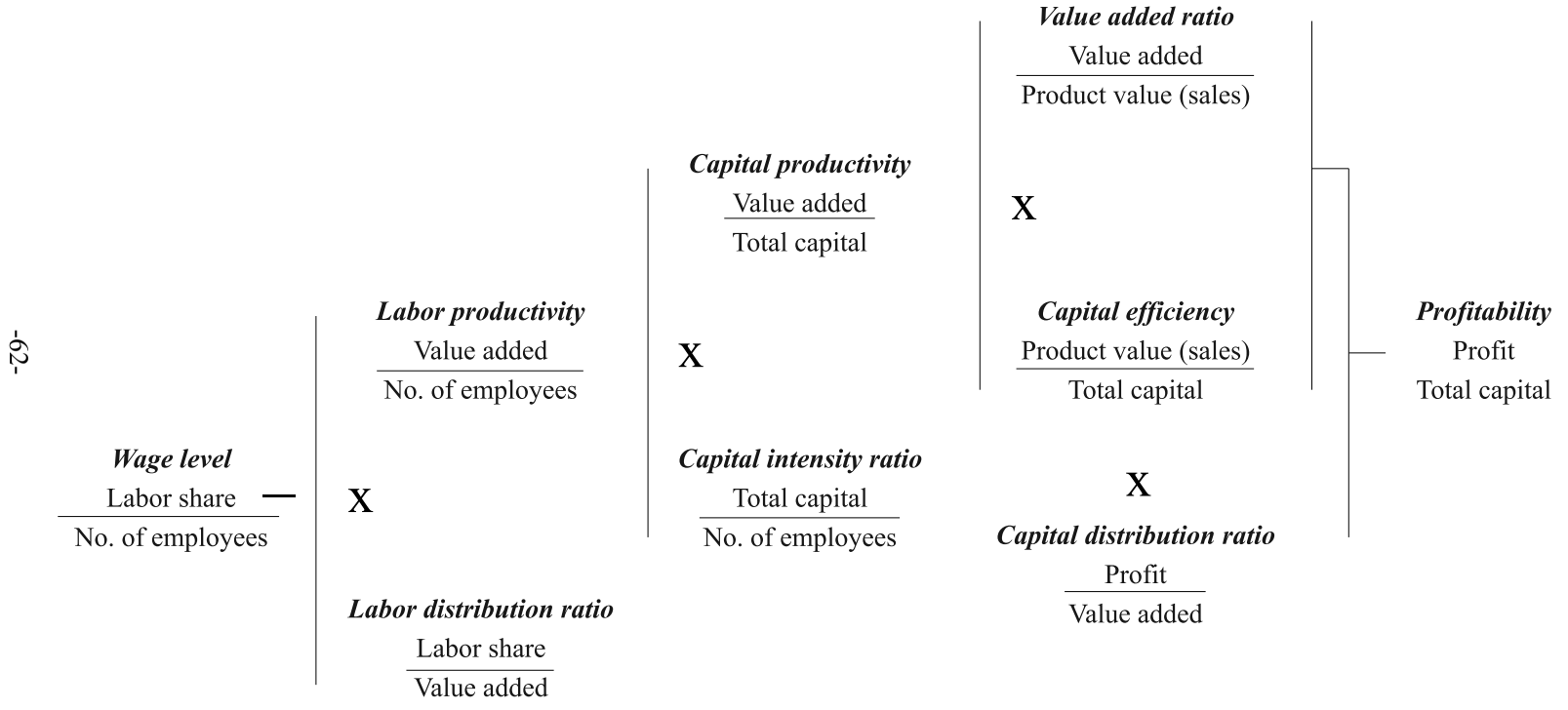
Factors Affecting Improvement in Labor Productivity (Value Added/Employee)



Productivity Improvement in the Workshop



Linkage between Productivity and Profitability



PRODUCTIVITY IN THE SERVICE SECTOR IN JAPAN

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INTRODUCTION

Classification of Industry

What is the service sector in terms of industrial classification? It is an industry that provides services and is a general term for the wholesale and retail trades; the finance and insurance industries; the real estate industry; transportation and communications services; and electricity, gas, and water supply services. The service industry provides labor, benefits and specific knowledge in the form of services to individuals and business operations - repairs, entertainment, medical insurance, legal affairs, educational support, and hotel services.

In Japan, there are many annual and industry-specific business management analysis statistics published by various public organizations including the Ministry of International Trade and Industry (MITI). This paper discusses productivity in the Japanese service sector, excluding the banking and insurance industry, based on information contained in industry-specific *Business Management Analysis Statistics* published by MITI in May 2000 relating to the 1998 fiscal year (April 1998 to March 1999). Most of the enterprises in Japan have financial years that run from April to March of the following year, in line with the fiscal year in government budgeting.

The *Business Management Analysis Statistics* published by MITI cover 1,674 enterprises, while the whole service sector represents more than ¥1 billion in capital stock. The industrial classification categories in the service sector are as follows:

- *Wholesale - 141 enterprises*
  General trading - 9;
  Textiles and garments - 14;
  Chemicals and pharmaceuticals - 10;
  Mining materials - 13;
  Machinery and tools - 49; and
  Construction material - 13.
- *Retail - 93 enterprises*
  Department stores - 18;
  Supermarkets - 30;
  Convenience stores - 3;
  Electric appliance bulk sales - 7;
  Sales (non-shop) - 6; and
  Other retail - 29.
- *Electricity and gas - 17 enterprises*
  Electricity - 10; and
  Gas - 7.
- *Transportation and communications - 91 enterprises*
  Railway transportation - 25;
  Road transportation - 18;
  Transportation by water - 16;
  Airline transportation - 5;
  Warehouse and harbor transportation - 23;
  Travel - 2; and
  Electric transportation - 2.

- *Restaurants - 18 enterprises*
- *Real estate - 36 enterprises*
  Housing development and building rental, etc.
- *Services - 62 enterprises*
  Leasing - 1;
  Hotels - 8;
  Movies - 4;
  Entertainment - 10;
  Broadcasting - 4;
  Information services - 6;
  Research and advertising - 12; and
  Others - 17.

Constraints to Industrial Classification in the Service Sector

Generally, banking and finance are not included in the business management analysis statistics in Japan. Compared to other industries, banking and insurance are strictly controlled by the government for the purposes of maintaining sound management. To this end, there is a requirement that specific indicators of performance are generated. These include a ratio of net worth to deposits in accordance with BIS regulations in banking, a solvency margin indicator in insurance, and an owned capital composite ratio in the security business. Accordingly, it is difficult to compare business management indicators in these industries with other industries. Thus the *Business Management Analysis Statistics* issued by MITI do not include management analysis indicators for banking and finance and are not exceptional as regards other statistics.

MANAGERIAL ENVIRONMENT IN THE 1998 FISCAL YEAR (APRIL 1998 TO MARCH 1999)

Despite what had been construed as a recovery in the mid-1990s, in 1998 the Japanese economy seemed to encounter yet another economic crisis that provided momentum toward an economic recession. In 1992 GDP growth in Japan was 0.4 percent and in 1993 0.5 percent. After low growth for three years from 1992 to 1994, the economy recovered to the extent of achieving real GDP growth of 3.0 percent in the 1995 fiscal year (1.5 percent per calendar year) and 4.4 percent in the 1996 fiscal year (5.1 percent per calendar year). This was considered a clear sign of an economic upturn. However, negative growth at -0.1 percent was recorded in the 1997 fiscal year (-1.6 percent per calendar year) and -1.9 percent in the 1998 fiscal year (-2.8 percent per calendar year).

Other environmental factors impacting business management at that time were:

- The bankruptcy of huge institutional organizations one after another, and a decreasing sense of reliance on the financial system following the bursting of the economic bubble;
- Constraints on loans by financial institutions and decreasing investment in equipment by enterprises;
- Decreasing exports and the depression of business activities through deflation and the monetary crisis in Asia;
- An increase in the value of doubtful assets because of reduced land prices and the accrual of losses from the devaluation of stock prices; and
- Constraints to consumption due to instability caused by mounting concern about unemployment and uncertainty regarding wages and salaries.

These environmental factors affected the business climate and prolonged the economic recession. This position is supported by analysis of the MITI statistics for the service industry and its constituent enterprises. Table 1 sets out the figures for growth in sales, net profit, and labor productivity in the service industry as a whole from the 1995 to the 1998 fiscal year. As can be seen from the table, there was a decline in all these indicators from 1997.

Table 1. Enterprise Performance Trends (Whole Service Sector: 1,674 Companies with more than ¥1 Billion Capital Stock)

	1995	1996	1997	1998
Increase/decrease in sales (%)	0.9	0.7	-0.6	-8.7
Increase/decrease in net profit (%)	33.3	13.7	-31.3	-75.1
Increase/decrease in labor productivity (%)	5.2	5.3	1.6	-3.9

- ***Sales growth*** **-** the growth in sales was 0.9 percent in the 1995 fiscal year, 0.7 percent in 1996, -0.6 percent in 1997 and -8.7 percent in 1998. Sales performance deteriorated gradually until 1998 when a sharp decline was experienced.
- ***Growth in net profit*** **-** the growth in net profit showed a downward trend from 33.3 percent in the 1995 fiscal year to 13.7 percent in 1996, after which it declined rapidly to -31.3 percent in 1997 and -75.1 percent in 1998.
- ***Growth in labor productivity (gross value added per capita)*** **-** the growth in labor productivity was 5.2 percent in 1995 and 5.3 percent in 1996 but declined in 1997 compared to previous years, at 1.6 percent, and dropped significantly in 1998, recording growth of -3.9 percent.

PRODUCTIVITY ANALYSIS

In this paper, productivity analysis indices in the wider sense are considered more important as regards the MITI industry-based *Business Management Analysis Statistics* for the 1998 fiscal year (April 1998 to March 1999). The following sections discuss profitability, liquidity and productivity (in its narrow sense) in this period for both the service sector as a whole and the industries within it.

Profitability

The profitability of shareholders' equity (ROE) in the service sector was generally very low, as can be seen from Table 2. Indeed, wholesale and restaurants showed negative returns. However, electricity and gas and transport and communications, as part of the national infrastructure, maintained better ratios and were not so affected by the downturn as other industries. For reference, Table 3 highlights the ROE trends for the 5-year period from 1994 to 1998.

Table 2. Profitability Indices: Whole Service Sector and Service Sector Industries (1998)

Index	Whole service sector	Service sector industries						
		Whole-sale	Retail	Electri-city & gas	Trans-portation & comm-unications	Restau-rants	Real estate	Services
Net profit to shareholders' equity, ROE (%)	0.68	-1.22	0.81	5.13	5.11	-2.37	1.62	1.81
Net profit to total capital (%)	0.23	-0.23	0.33	0.78	1.36	-1.48	0.33	0.91
Total capital turnover ratio (time)	0.91	2.25	1.35	0.38	0.51	1.11	0.28	0.62
Net profit to sales (%)	0.25	-0.09	0.25	2.06	2.67	-1.34	1.11	1.47
Ordinary profit to sales (%)	2.51	0.64	2.65	4.60	3.81	4.32	2.39	7.43
Break-even point (%)	91.66	82.59	90.21	93.65	94.91	93.24	93.21	87.26

Note: Breakeven point is calculated on the basis of ordinary profit

The total capital turnover ratio (Table 2) shows a distinctive character from industry to industry, with wholesale the highest at 2.25, retail at 1.35 and restaurants at 1.11. These industries were at the top end of the scale, while electricity and gas at 0.38 was at the bottom end, along with transport and communications at 0.51, real estate at 0.28 and services at 0.62.

Table 3. Trends in the Profitability of Shareholders' Equity (ROE): 1994-98

	1994	1995	1996	1997	1998
Whole service sector	2.86	3.73	4.11	2.75	0.68
Service sector industries					
• **Wholesale**	-1.15	2.88	0.58	0.89	-1.22
• **Retail**	3.32	4.04	4.92	1.62	0.81
• **Electricity and gas**	4.87	4.75	4.68	6.09	5.13
• **Transportation & communications**	2.84	4.78	4.55	3.08	5.11
• **Restaurants**	4.21	4.09	4.14	3.22	-2.37
• **Real estate**	2.11	-5.47	0.33	-9.07	1.62
• **Services**	3.48	3.63	3.05	2.67	1.81

From these figures, it can be seen that the profitability of all service industries in Japan showed a downward trend over the five years with the exception of electricity and gas and transport and communications. These industries maintained a fairly stable position.

Liquidity

Table 4 sets out the liquidity figures for the 1998 fiscal year.

Table 4. Liquidity Index: Whole Service Sector and Service Sector Industries (1998)

Index	Whole service sector	Service sector industries						
		Whole-sale	Retail	Electri-city & gas	Trans-portation & comm-unications	Restau-rants	Real estate	Services
Current ratio (%)	123.86	125.11	89.23	22.47	91.05	151.01	108.95	136.33
Quick ratio (%)	81.28	95.22	48.21	15.75	53.77	126.75	22.45	110.68
Fixed assets to fixed liabilities & shareholders' equity (%)	86.89	71.13	105.88	117.83	103.21	89.25	94.68	85.65
Shareholders' equity to total capital (%)	33.65	16.95	41.14	15.26	26.91	60.94	18.77	50.75

The current ratio for the majority of service sector industries in 1998 was lower than the sector average of 123.86 percent. Exceptions were restaurants at 151.01 percent, services at 136.33 percent and wholesale at 125.11 percent. Electricity and gas was at the bottom of the scale for this ratio. However, this is a public and monopolistic type of industry where the structure leads to a relatively larger proportion of short-term debt. Examination of the five-year trend in the shareholders' total capital (equity) ratio (Table 5) reveals a fairly stable picture in the individual industries in the service sector, even though there were some clear differences between industries. However, liquidity and financial composition seem sound.

Table 5. Trends in Shareholders' Capital (Equity) (%): 1994-98

	1994	1995	1996	1997	1998
Whole service sector	31.62	31.89	32.75	33.36	33.65
Service sector industries					
• **Wholesale**	15.09	15.29	15.94	16.16	16.95
• **Retail**	40.97	41.02	42.43	41.86	41.14
• **Electricity and gas**	15.74	15.32	15.11	15.23	15.26
• **Transportation & communications**	25.28	25.51	26.24	26.61	26.91
• **Restaurants**	63.51	64.68	64.04	63.89	60.94
• **Real estate**	20.09	19.46	19.99	18.62	18.77
• **Services**	47.98	48.55	49.55	50.54	50.75

Productivity (Narrow Sense)

Table 6 shows the productivity indices for the whole service sector and the industries within it for the 1998 fiscal year.

Table 6. Productivity Indices (Narrow Sense): Whole Service Sector and Service Sector Industries (1998)

Index	Whole service sector	Service sector industries						
		Whole-sale	Retail	Electri-city & gas	Trans-portation & comm-unications	Restau-rants	Real estate	Services
Labor productivity (¥ thousands)	16,005	15,420	17.602	52,028	18,885	23,405	54,498	14,168
Sales per person (¥ thousands)	82,552	601,551	92,259	96,774	34,034	47,084	192,298	34,805
Gross value added (%)	19.39	2.56	19.08	53.76	55.49	49.71	28.34	40.71
Labor intensity ratio (¥ thousands)	30,067	18,306	22,025	195,104	42,899	14,501	270,501	19,781
Tangible fixed asset turnover (times)	2.75	32.86	4.19	0.55	2.93	3.25	0.71	1.76
Total capital productivity (%)	17.64	5.76	25.77	20.41	28.38	54.94	7.83	25.35
Total capital per person (¥ thousands)	90,710	267,739	68,300	254,894	66,531	42,599	695,580	55,880
Equipment capital productivity (%)	53.23	84.24	79.92	26.67	44.02	161.44	20.15	71.63
Labor distribution ratio (%)	53.37	61.65	50.62	23.69	45.14	60.43	16.87	55.76
Personnel expenses per person (¥ thousands)	8,541	9,506	8,910	12,323	8,525	14,144	9,196	7,900
Capital distribution ratio (%)	27.03	6.53	12.87	54.59	32.42	9.03	33.13	15.39
Depreciation expense in capital distribution (%)	21.3	8.98	9.16	37.47	24.55	6.95	13.78	12.95

Note: The capital distribution ratio in wholesale is lower than depreciation because net financial cost in the case of wholesale is negative.

The productivity indices discussed in this section are labor productivity, capital productivity and the labor distribution ratio.

Labor Productivity

The trends in labor productivity - gross value added/number of employees - over the period from 1994 to 1998 for both the whole service sector and the various industries it comprises are illustrated in Table 7.

Table 7. Labor Productivity Trends in the Service Sector (¥ Thousands): 1994-98

	1994	1995	1996	1997	1998
Whole service sector	14,787	15,551	16,381	16,646	16,005
Service sector industries					
• **Wholesale**	14,920	15,692	16,401	16,285	15,420
• **Retail**	14,908	15,842	16,886	17,204	17,602
• **Electricity and gas**	46,720	47,580	48,055	50,982	52,028
• **Transportation & communications**	16,994	17,929	18,302	18,658	18,885
• **Restaurants**	21,055	21,567	22,577	23,016	23,045
• **Real estate**	57,820	53,614	47,596	52,394	54,498
• **Services**	12,727	13,335	14,261	14,696	14,168

As can be seen from the table, in the 1998 fiscal year labor productivity in the service sector as a whole dropped relative to 1997 but was still higher than in 1994. Apart from some declines in wholesale and services, generally labor productivity increased. In the electricity and gas and real estate industries it was higher than in the other industries in the sector. This was due to the fact that these industries include a higher portion of depreciation in gross value added. As regards real estate, labor productivity is recovering even though there are fluctuations year by year. From the tables, it can be seen that labor productivity in the majority of service sector industries was higher than the sector average in all of the five years reviewed.

Labor productivity is composed of two factors, sales per person and gross value added. As regards these two factors in the different service sector industries, in wholesale sales per person is very high but gross value added is remarkably low. On the other hand, electricity and gas, transportation and communications, restaurants and services are characterized in general by high gross value added.

Sales per person is also a type of productivity index and is divided into two other factors, the labor intensity ratio and the tangible fixed assets turnover ratio. In this regard, a characteristic of wholesale is a low labor intensity ratio but a high tangible fixed assets turnover ratio. In contrast, electricity and gas and real estate have a high labor intensity ratio and a low tangible fixed assets turnover ratio.

Capital Productivity

As can be seen from Table 6, total capital productivity for the whole sector in the 1998 fiscal year was 17.64 percent, with wholesale at 5.76 percent, retail 25.77 percent, electricity and gas 20.41 percent, transportation and communications 28.38 percent, restaurants 54.94 percent, real estate 7.83 percent, and services 25.35 percent. Wholesale and real estate were low and restaurants high.

Total capital productivity is divided into two factors, total capital turnover and gross value added. The various service sector industries have different characteristics in this regard. For example, total capital turnover in wholesale is high but gross value added is very low. Total capital turnover in electricity and gas and transportation and communications is low but gross value added is high, while both total capital turnover and gross value added are higher in restaurants, and accordingly total capital productivity is high. Total capital productivity in real estate is low because total capital turnover is very low, even though gross value added is not so low. On the other hand, total capital productivity in services is better because gross value added is high even though total capital turnover is rather low.

As a next step, where productivity is highly correlated with investment in equipment, it may be useful to examine equipment capital productivity. Average equipment capital productivity in the whole sector in 1998 was 53.23 percent (Table 8), while in wholesale it was 84.24 percent, in retail 79.92 percent, in electricity and gas 26.67 percent, in transportation and communications 44.02 percent, in restaurants 161.44 percent, in real estate 20.15 percent, and in services 71.63 percent. It was lowest in electricity and gas and real estate, which is characteristic of equipment-intensive types of industry.

The five-year trends in equipment capital productivity can also be seen in Table 8:

Table 8. Equipment Capital Productivity Trends in the Service Sector (%): 1994-98

	1994	1995	1996	1997	1998
Whole service sector	58.01	58.59	59.31	57.74	53.23
Service sector industries					
• **Wholesale**	104.53	103.83	101.35	93.11	84.24
• **Retail**	85.44	85.53	84.89	81.62	79.92
• **Electricity and gas**	27.02	26.82	26.33	26.94	26.67
• **Transportation & communications**	46.57	47.29	47.11	45.81	44.02
• **Restaurants**	170.86	173.55	176.01	168.51	161.44
• **Real estate**	24.82	22.36	19.65	21.55	20.15
• **Services**	73.36	70.95	73.44	75.44	71.63

The fluctuation in equipment capital productivity in the service sector in general year by year was small, although it was greater in the wholesale industry to some extent. There was, however, a downward trend in the individual industries as well as the whole sector over the five-year period. This can be attributed to the holding of surplus equipment as well as excessive employment during the era of the bubble economy. Because it is part of the national infrastructure, the electricity and gas industry assumes great importance. It should be noted therefore that, while equipment capital productivity in the service sector in general has decreased, it has stabilized in this industry.

Labor Distribution Ratio

The sector average for labor distribution in the 1998 fiscal year was 53.37 percent, while in wholesale it was 61.65 percent, in retail 50.62 percent, in electricity and gas 23.69 percent, in transportation and communications 45.14 percent, in restaurants 60.43 percent, in real estate 16.87 percent and in services 55.76 percent. The remarkably low ratios recorded by electricity and gas and real estate are characteristic of these industries.

The trends in the labor distribution ratio over the past five years are shown in Table 9:

Table 9. Trends in the Labor Distribution Ratio in the Service Sector (%): 1994-98

	1994	1995	1996	1997	1998
Whole service sector	52.54	51.72	51.11	51.72	53.37
Service sector industries					
• **Wholesale**	58.15	57.66	57.22	58.81	61.65
• **Retail**	50.74	49.79	49.94	50.67	50.62
• **Electricity and gas**	21.42	22.21	22.23	22.66	23.69
• **Transportation & communications**	48.37	46.85	46.22	46.01	45.14
• **Restaurants**	57.27	57.68	58.32	60.00	60.43
• **Real estate**	15.16	16.87	19.01	17.37	16.87
• **Services**	55.44	55.05	54.41	54.17	55.76

From this table it can be seen that the labor distribution ratio in individual industries such as wholesale, retail, electricity and gas, restaurants, and services, as well as in the sector as a whole, was gradually increasing over the review period. Exceptions were transportation and communications and real estate.

The labor distribution ratio is divided into two factors, personnel expenses per person and labor productivity. For the 1998 fiscal year, in wholesale, personnel expenses per person was slightly on the high side, but labor productivity was low and the net effect was that the labor distribution ratio was high. The personnel expense level in electricity and gas was high but labor productivity was very high, and therefore the labor distribution ratio was low. In restaurants, labor productivity was rather high but the personnel expense level was higher, hence the labor distribution ratio was high. In the case of real estate, the personnel expense level was reasonable but labor productivity was high, resulting in a labor distribution ratio that was remarkably low. The personnel expense level in services was rather low but labor productivity was also low, and hence the labor distribution ratio was a little on the high side.

CONCLUSIONS

To summarize the above analysis, profitability in all the service sector industries examined except electricity and gas and transportation and communications was very low over the five years under review and this constitutes a serious problem. Even though profitability in these two industries was comparatively higher than in the other industries, there still seems to be a considerable gap in return on equity - as measured by the ratio of net profit to shareholders' equity - between Japan's performance and internationally accepted standards. There appears to have been a particular problem in achieving profitability in most of the individual industries in the sector. However, liquidity in each industry was reasonable and the composition of capital and the financial constitution are considered to be healthy.

Productivity in its narrow sense in the service sector as a whole is judged to have been reasonable over the review period, although there was a downward trend in equipment capital productivity. Labor productivity, as the more representative indicator of productivity, was high. Therefore, despite low profitability, there seems to be no specific problem with regard to productivity levels in the service sector in Japan.

Appendix

Productivity Indices and Calculation Methods

Profitability

(1) net profit for the term to shareholders' equity (%) = $\frac{\text{net profit for the term}}{\text{shareholders' equity (average)}}$

(2) net profit for the term to total capital (%) = $\frac{\text{net profit for the term}}{\text{total liabilities and capital (average)}}$

(3) total capital turnover (time) = $\frac{\text{sales}}{\text{total liabilities and shareholders' equity (average)}}$

(4) net profit for the term to sales (%) = $\frac{\text{net profit for the term}}{\text{sales}}$

(5) ordinary profit to sales (%) = $\frac{\text{ordinary profit}}{\text{sales}}$

(6) Break-even point (%) = $\frac{\text{fixed cost ratio to sales}}{\text{100 - variable cost ratio to sales}}$

Liquidity

(1) current ratio (%) = $\frac{\text{current assets}}{\text{current liabilities}}$

(2) quick ratio (%) = $\frac{\text{quick assets}}{\text{current liabilities}}$

(3) fixed assets to fixed liabilities and shareholders' equity (%) = $\frac{\text{fixed assets}}{\text{total fixed liabilities and shareholders' equity}}$

(4) shareholders' equity ratio (%) = $\frac{\text{share holders' equity}}{\text{total liabilities and shareholders' equity}}$

Productivity (narrow sense)

(1) labor productivity (¥ thousands) = $\frac{\text{gross value}}{\text{number of employees (average)}}$

Note: gross value added = net profit for the term (ordinary profit after tax) + personnel expenses + tax + rent + patent fees + net finance cost (finance cost - finance profit) + depreciation

(2) sales per person(¥ thousands) = $\frac{\text{sales}}{\text{number of employees (average)}}$

(3) gross value added ratio (%) = $\frac{\text{gross value added}}{\text{sales}}$

(4) labor intensity ratio (¥ thousands) = $\frac{\text{tangible fixed assets}}{\text{number of employees (average)}}$

(5) tangible fixed assets turnover ratio (time) = $\frac{\text{sales}}{\text{tangible fixed assets (average)}}$

(6) total capital productivity (%) = $\frac{\text{gross value added}}{\text{total liabilities and shareholders' equity}}$

(7) total capital per person (¥ thousands) = $\frac{\text{total liabilities and shareholders' equity}}{\text{number of employees (average)}}$

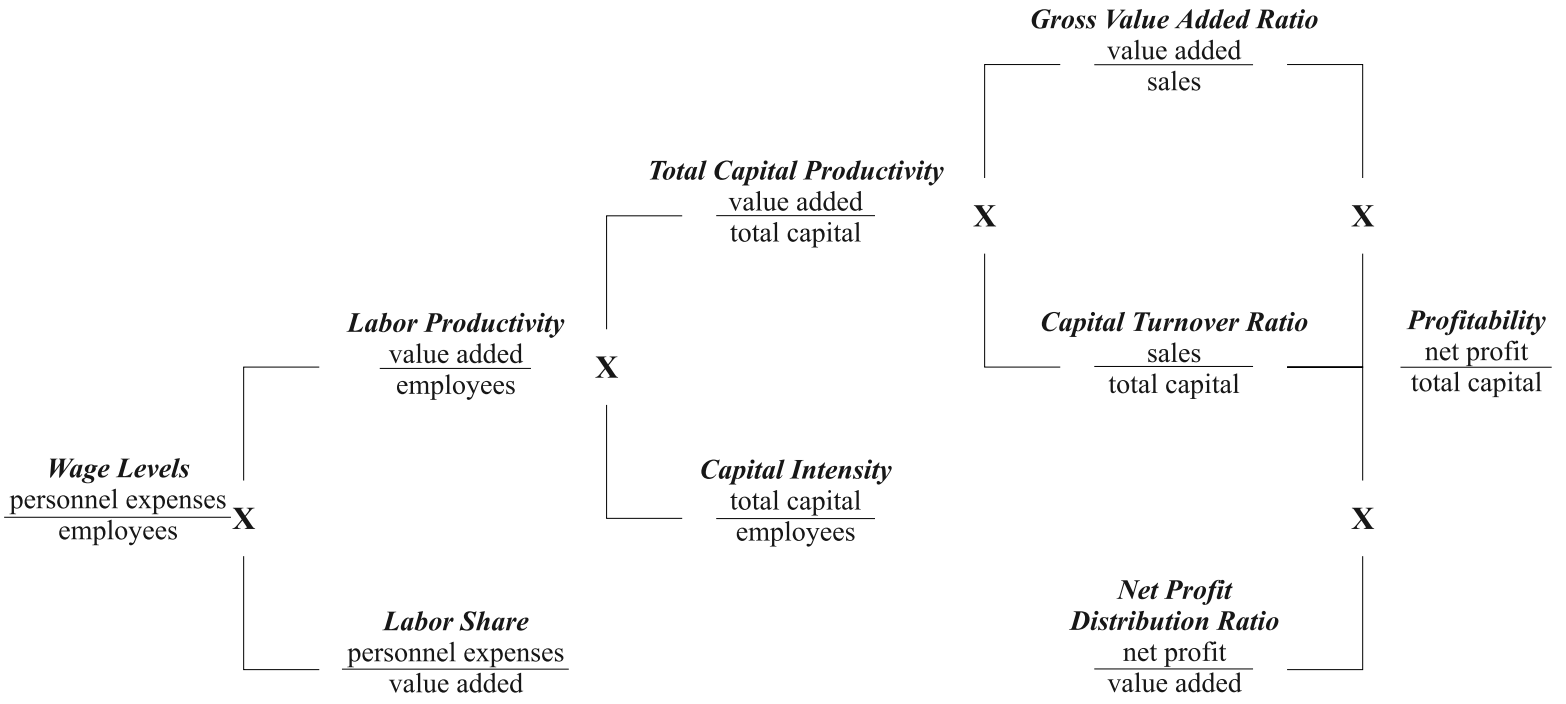
(8) equipment capital productivity (%) = $\frac{\text{gross value added}}{\text{tangible fixed assets (average)}}$

(9) labor distribution ratio (%) = $\frac{\text{personnel expenses}}{\text{gross value added}}$

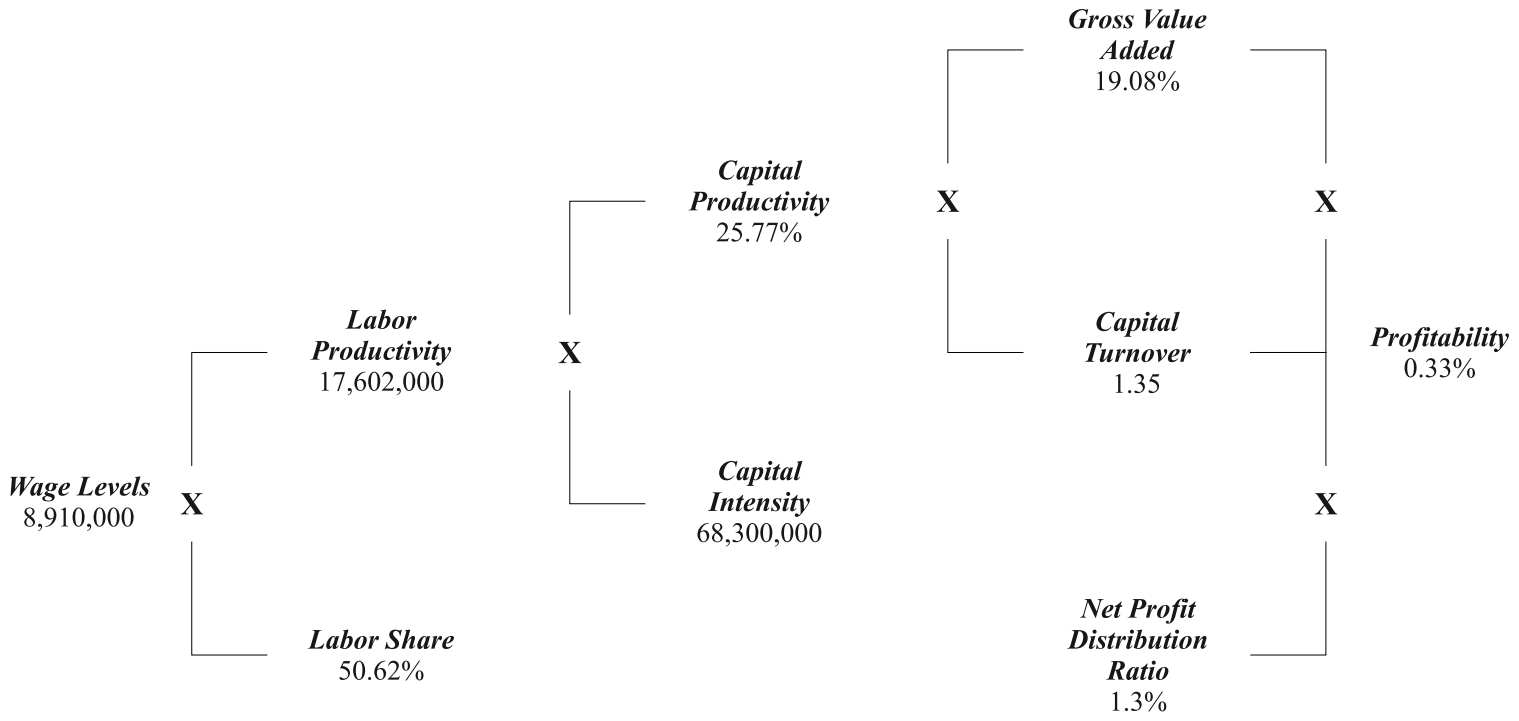
(10) personnel expenses per person (¥ thousands) = $\frac{\text{personnel expenses}}{\text{number of employees (average)}}$

(11) capital distribution ratio (%) = $\frac{\text{net finance cost + dividends + depreciation}}{\text{gross value added}}$

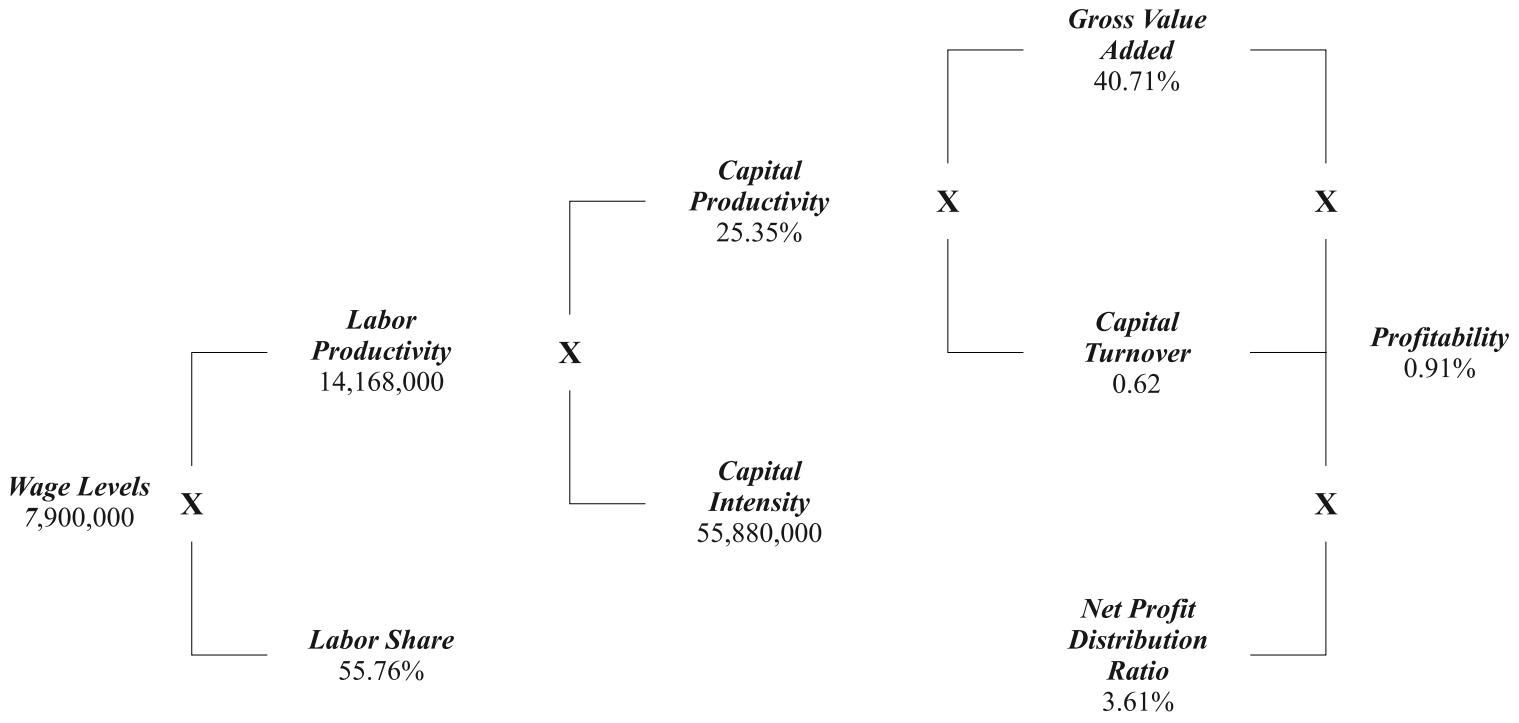
Linkage between Productivity and Profitability



Linkage between Productivity and Profitability in Retail



Linkage between Productivity and Profitability in Services



THE PRODUCTIVITY FRAMEWORK, PRODUCTIVITY IN THE SERVICE SECTOR & THE PRODUCTIVITY PARADOX

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INTRODUCTION

Productivity is the key word in raising competitiveness and consequently the prosperity of a nation. It is responsible for the continued growth of the important sectors of the economy. In the last 10 years, the manufacturing sector has overtaken the agricultural sector in terms of its contribution to Gross Domestic Product (GDP). However, in Malaysia, by 1995 the tertiary sector (the service sector) was leading the other sectors by contributing 51.2 percent to GDP. The secondary sector (manufacturing and construction) contributed 31.6 percent, while the primary sector (agriculture and mining & quarrying) contributed only 18.5 percent. In 2000, the contribution of the secondary sector rose to 36.7 percent at the expense of the primary sector, which contributed only 15.3 percent to GDP. The tertiary sector increased its contribution marginally to 52.4 percent (Table 1).

Table 1. Percentage Contribution to GDP by Three Major Sectors, 1995 & 2000

Sector	1995	2000
Primary Sector	18.5	15.3
Secondary Sector	31.6	36.7
Tertiary Sector	51.2	52.4

This trend of an increasing tertiary (service) sector contribution to GDP runs parallel with the growth pattern in developed industrial nations. Malaysia is closely following this healthy trend. Its employment pattern is following a similar trend, whereby service sector employment has risen from 46.5 percent of total employment in 1995 to 48.7 percent in 2000 (Table 2).

Table 2. Percentage of Total Employment in Three Major Sectors, 1995 & 2000

Sector	1995	2000
Primary Sector	19.2	15.6
Secondary Sector	34.3	35.7
Tertiary Sector	46.5	48.7

Productivity is important in determining growth in output, besides the contribution of inputs such as labor and capital. Growth in output and the prosperity of the people hinges not only on input factors but, more importantly and decisively, on productivity growth.

THE PRODUCTIVITY FRAMEWORK

Productivity is important for every country for the following reasons:

Sustainable growth

In the context of sustainability the emphasis is on productivity-driven growth rather than input-driven growth. Economic growth can normally be generated by increasing input factors such as material, capital and labor. This is called input-driven growth. However, in the more recent development among nations, it is productivity growth that ensures sustainable and more rapid economic growth. Productivity growth means better utilization of inputs to generate higher levels of output. It may mean that, with the same level of inputs, much more output can be generated merely by ensuring more effective utilization of resources. This can be achieved through qualitative changes such as using more highly trained, skilled and experienced workers and/or more sophisticated and innovative processes and machinery.

Equitable sharing of wealth created

Through faster economic growth, propelled by productivity growth, higher levels of prosperity can be created for the workers and the general population. Productivity gains ensure higher profitability - wealth that is available for equitable distribution to business stakeholders, the workforce, investors and consumers.

Efficient usage of input factors

It is through the more effective and efficient utilization of input factors that productivity is improved. Higher levels of output ensure greater economies of scale, better utilization of capital input (fixed assets) to generate output, and more effective use of labor inputs and materials (which may be both more efficiently processed and purchased in larger quantities at reduced costs). It is possible, even in nominal terms, to reduce input costs per unit of output through increases in productivity.

Better labor relations

Productivity gains ensure a bigger 'cake' to be distributed to the relevant parties involved in wealth creation, including the workforce. Workers may enjoy higher wage rates, bonuses and other benefits leading to higher standards of living. Increased prosperity tends to promote contentment among workers and management, thus promising better labor relations.

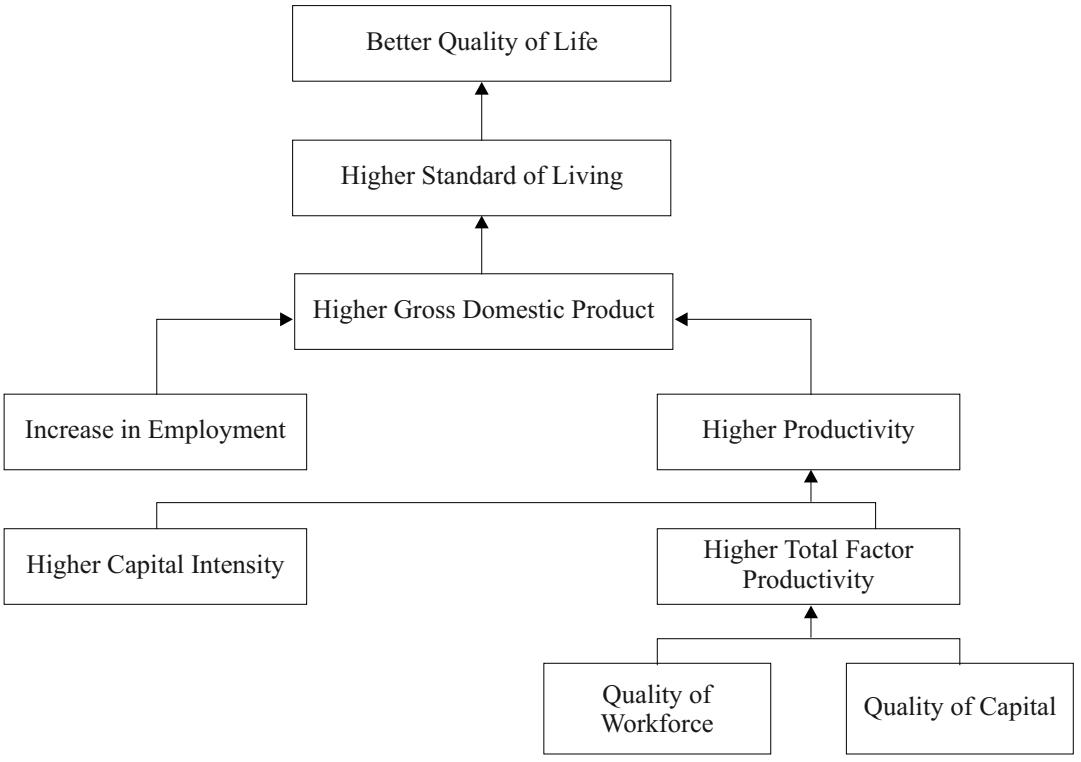
Productivity growth yields many benefits to the nation, producers, consumers, workers and the government. These are summarized in Table 3.

Table 3. Benefits of Productivity Growth for Stakeholders

Nation	Producers	Consumers	Workers	Government
• Enhanced ompetitiveness in world markets • Creation of more employment opportunities • Higher standard of living for the people	• Expanded capital formation • Upgraded technical capability • Improved competitive position in the market	• Lower prices of goods and services • Better quality of goods and services	• Increases in compensation • Better working conditions • Job security • Greater sense of wellbeing • Development of skills and capabilities	• Ability to provide more and better social services • Ability to carry out development programs more effectively and efficiently

The productivity framework illustrated in Figure 1 is based on the contribution of both quantitative and qualitative input.

Figure 1. The Productivity Framework



Increases in quantitative input take the form of increases in the capital input (capital intensity) and the labor input (increases in employment). Increases in capital intensity together with higher total factor productivity (TFP) raise the productivity performance. An improved productivity performance together with an increase in employment in turn raises the gross domestic product, which finally raises the standard of living and quality of life.

Increases in qualitative input take the form of higher workforce quality (more skillful and experienced workers) and better quality capital and systems (more innovative and sophisticated machinery, etc.) These factors contribute towards higher TFP. Higher TFP together with higher capital intensity raises the productivity performance. This, together with employment growth, in turn raises the GDP of the nation. With a higher GDP, the people (workers, investors, entrepreneurs, public servants, etc.) enjoy a higher income level and a higher standard of living and better quality of life.

PRODUCTIVITY IN THE SERVICE SECTOR

Labor Productivity in the Service Sector

In Malaysia, labor productivity growth in the service sector rose to a peak of 5.6 percent in 1997, from 4.4 percent in 1996, and then declined by -2.3 percent in 1998 due to the economic crisis. In 1999 the growth rate turned positive again at 0.9 percent to indicate economic recovery at that time. It is expected to be even higher in 2000.

The service sector comprises four main sub-sectors: electricity, transport, commerce/trade, and finance. The productivity growth performance in selected sectors in Malaysia vis-à-vis Taiwan, Japan and Singapore is shown in Table 4.

Table 4. Productivity Growth in Selected Sectors (%)

	Manufacturing Sector			Transport Sector			Trade Sector			Finance sector		
Country	1997	1998	1999	1997	1998	1999	1997	1998	1999	1997	1998	1999
Malaysia	5.7	-7.0	9.1	8.4	1.0	3.2	6.4	-0.2	1.2	5.8	1.8	-0.4
Taiwan	0.5	2.3	9.5	N/A	8.1	N/A	N/A	5.6	4.3	N/A	-2.9	0.6
Singapore	2.3	2.0	16.2	1.6	7.1	8.7	7.8	-4.4	6.8	-0.1	-8.8	N/A
Japan	1.0	-2.7	N/A	0.1	0.2	N/A	2.4	-4.0	N/A	8.8	-2.5	N/A

Note: The figures for 1999 are estimated.

In 1997 Malaysia experienced faster growth than the other countries in manufacturing and transport. Only in finance did Japan's productivity growth rate exceed that of Malaysia, while in trade Singapore was the leader. In 1998 Malaysia's productivity growth in manufacturing declined below that of the other countries. In trade its productivity growth also declined, although Taiwan and Singapore experienced a much greater decline. Finance in Malaysia showed positive growth in that year at 1.8 percent, though it declined in all the other countries. A recovery in all the sectors was anticipated in 1999, with the exception of finance, which was expected to decline slightly.

In general, Malaysia's transport sector grew the fastest in 1997 (8.4 percent), grew modestly at 1.0 percent in 1998, and was expected to grow by 3.2 percent in 1999. Its trade sector grew at a slower rate in 1997 (6.4 percent), declined in 1998 (-0.2 percent), and then was expected to grow by 1.2 percent in 1999. The finance sector experienced positive growth in 1997 (5.8 percent) and in 1998 (1.8 percent). However, it was expected to decline in 1999 (-0.4 percent).

Productivity Indicators

There are many ratios and indicators relating to productivity performance. However, the following six key indicators present a fair picture of productivity growth within an organization:

- Added Value per Employee (Labor Productivity);
- Labor Cost per Employee;
- Added Value/Labor Cost;
- Unit Labor Cost;
- Fixed Assets per Employee; and
- Process Efficiency.

Table 5 summarizes what these indicators measure:

Table 5. Key Indicators of Organizational Productivity

Indicators	What They Tell
1. Added Value per Employee	Measures the contribution of each employee in creating the net output of the firm. A high ratio indicates a favorable effect in terms of labor's input to wealth creation.
2. Labor Cost per Employee	Indicates the level of income of each employee in return for their experience, skill and effort. It is expected to grow, but must never exceed labor productivity growth.
3. Added Value/Labor Cost	Measures the labor cost competitiveness of the firm. It indicates how much added value is generated for each RM of labor cost.
4. Unit Labor Cost = Total Labor Cost/Total Output	Represents the cost of labor required to produce one unit of output. Increases in labor productivity will reduce unit labor cost whereas increases in labor cost per employee (compensation) will increase it.
5. Fixed Assets per Employee	Measures capital intensity. It tells how much capital is made available to each employee.
6. Process Efficiency = Added Value/(Total Input - Bought-in Materials & Services)	Measures how effectively inputs of labor and capital are utilized in generating the added value. It may also be called the productivity of the combined inputs of capital and labor, or a proxy for total factor productivity.

THE PRODUCTIVITY PARADOX

Productivity growth has slowed down in every decade since the 1960s, despite increasingly massive investment in information technology (IT). It is said that computers are seen everywhere, but their impact on productivity statistics is not seen. The inability of productivity measures to show any impact from investment in computers and IT has been labeled the 'productivity paradox'. Because of it, some people think that IT does not affect productivity.

In the past, productivity in the manufacturing and agricultural sectors grew at 3 to 4 percent per annum due to mechanization. Today, in developed countries, more than 80 percent of the labor force works in the service sector, yet productivity growth in this sector is less than 1 percent per year. The role of mechanization as the predominant productivity driver is dwindling. There is a strong possibility, however, that IT can play its role in raising productivity at macro level in the future and will be the major driver of productivity improvement, just like mechanization was in the past.

At the moment, the impact of IT on macro level productivity is not visible, probably due to its very recent application and limited use. At the firm level, however, there are findings from empirical research which indicate that investment in computers does improve productivity. The productivity of sectors that have invested heavily in computers has risen by 1.1 percent since the 1970s, while the productivity of those that have not done so has risen by only some 0.35 percent. Research by economists at the Massachusetts Institute of Technology (MIT) has also indicated that in the 1990s computers contributed significantly to output and productivity in certain firms and industries. As digitization is implemented widely in the economy, the effect will be felt more widely.

Further research involving a large number of firms has also indicated that the return on investment for computer capital averaged 81 percent for the firms in the survey sample. It is proven that information systems (IS) spending on labor generates several times more output than non-IS spending. These and other findings begin to indicate that the paradox is being disproved, and its effects are gradually disappearing. At the macro level, productivity improvement due to IT investment may not be proven yet but, since this has happened at the firm and industry level, it is likely to be only be a matter of time before the requisite evidence appears.

PRODUCTIVITY MEASUREMENT IN THE SERVICE INDUSTRY

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INTRODUCTION

Public sector productivity literature has variously defined productivity as efficiency, effectiveness, cost reduction, management improvement, work measurement and program evaluation. Productivity measures can be divided into three categories based on what they measure:

- Measures focusing on operational issues;
- Measures focusing on organizational or program output - known as technical efficiency measures; and
- Measures concerning organizational or program consequences/impact - known as effectiveness measures.

Operational measures are concerned with the internal workings of an organization. Examples of this type of measure are number of reports produced, number of audits completed and utilization measures, e.g. equipment downtime.

The second category of productivity measures, concerned with direct outputs, relate to the final organizational output in terms of the resources used to produce it. They measure the efficiency with which manpower, machines, and materials are used in the organization. These measures are also known as technical efficiency measures. Examples of such measures are: Total Revenue – Purchasing Costs/Total Employees; Total Revenue/Total Costs; Total Costs/Total Employees; Total Taxes Collected/Population (in municipal councils); and Total Revenue Received/Total Employees Required.

The third category of measures address the issue of the impact of programs on society and effectiveness in accomplishing organizational or program objectives and goals. These measures cover the quality of the services provided to the community (reliability, customer satisfaction, responsiveness, competence, timeliness, and availability). Examples are: Number of Services x Population/Total Costs; and Number of Services x Operating Budget/Population.

This paper focuses on the methodology of measuring productivity in the public sector based on operational measures - efficiency and effectiveness measures.

BASIC MEASUREMENT ISSUES

The specification and measurement of output is the most difficult problem in measuring the productivity of government services. The basic issues in measuring output are:

- Identifying the output - intermediate (used inside the organization) or final (used outside the organization);
- Measuring output (types of measures - cost or quantity);
- Output homogeneity; and
- Identifying/Matching related inputs to outputs.

METHODOLOGY FOR MEASURING GOVERNMENT PRODUCTIVITY

A well-designed measurement system allows an agency to arrive at an index that represents the combination of several measurement efforts. Depending on the desired performance information, agencies may have to use more than one kind of measurement. Examples of the various measurement systems are discussed in the paragraphs that follow.

Work Measurement

Work measurement is a traditional measurement method applying industrial engineering techniques. It focuses on efficiency measures and the various industrial engineering techniques used are:

- Informal - Supervising workers to observe the time taken to handle one unit of work.
- Semi-formal - Work Sampling. This involves listing the basic tasks performed, random observations to determine the sample time, and construction of the standard time by dividing the volume of output by the sample time.
- Formal - This requires definition of a job in terms of its elements and choosing a qualified employee to be used to determine the standard time to perform the task.

These measures focus on efficiency and a wide range of productivity indicators based on the generic ratio (output/input) can be developed. Productivity measurement is usually done in two dimensions:

- The ratio of output units delivered per unit of input resources expended (productivity level) at a point in time; and
- The trend of this ratio over time (the productivity trend).

A major problem in existing government performance measurement systems is aggregation, as reported by many public agencies to their elected officials and the public. To compute a productivity measure when an activity produces a single output, we simply match the output quantity to labor hours or cost. However, as most government organizations produce multiple outputs from a single program or service, total output is computed using a technique called weighting (finding a common denominator). The outputs are converted to equivalent units that can be added together and the results expressed as a single number, as shown in Table 1. Weights would be based typically on relative labor input per unit of output in the base year. The average annual compounded productivity growth in this department over the three-year period is 8.3 percent, with the year 2000 appearing to be noticeably more productive than 1999. The increase in labor productivity for the period under review reflects an increase in output of 15.0 percent and a decline in labor input of 2.0 percent relative to 1998.

Table 1. Productivity Index (1998=100)

Department A	Output Index	Input Index	Productivity Index (Output Index/Input Index)*100
1998	1.00	1.00	100.00
1999	1.04	1.003	103.68
2000	1.15	0.98	117.35

The steps involved in computing the productivity indexes are as follows:

1. Compute the weighted output;
2. Compute the output index;
3. Compute an input index; and
4. Divide the output index by the input index to calculate the productivity index.

Family of Measures

A more effective method of evaluating the productivity of service provision is the Family of Measures (FOM) approach proposed by the American Productivity and Quality Center. Table 2 presents an example of the FOM of a research unit and its overall change in performance. The result shows that the unit's overall performance declined by 10.75 percent.

Table 2. Example of Family of Measures Method

	Base	Current	Index	Weight (%)	Weighted Change (%)
No. of research projects realized/Total research projects	85	90	1.05	55	57.75
No. of papers in peer-reviewed journals/No. of papers published	15	10	0.70	15	10.50
No. of papers per research area	45	30	0.70	30	21
Total				100	89.25

The steps involved in formulating the FOM are:

1. Classify the types of services and service functions;
2. Identify objectives and relevant indicators; and
3. Aggregate the FOM.

Objectives Matrix

The Objectives Matrix is another form of measurement system that can be developed in order to measure a department or process. This method is more comprehensive as well as being flexible. It can be used to derive a composite index for the entire organization. The product of the score and the weights gives the value of each department's performance. As an example, Table 3 presents the objectives matrix of an accounts department. With a base index of 300 (a score of 3 for each of the measures, multiplied by the weights), the current score of 435 means that the performance of this department has increased by approximately 45 percent.

Table 3. Example of an Objectives Matrix

Post Issue Error Rate	Cycle Time Routine Reports	Special Reports Index	Documentation Index	Total Audit Cost per Year	Indicators
5.0	4.1	75	86	21.3	Performance
3.0	2.5	90	95	10.0	10
3.5	2.8	89	94	11.2	9
4.0	3.1	87	92	12.4	8
4.7	3.4	85	90	13.8	7
5.4	3.8	83	88	15.4	6
6.3	4.2	81	86	17.2	5
7.3	4.7	79	84	19.2	4
8.5	5.3	77	82	21.3	3
10.0	5.9	75	80	23.5	2
11.7	6.6	73	78	27.0	1
13.5	7.5	70	75	30	0
6.6	*5.2*	*2.0*	*5.0*	*3.0*	*Score*
25	25	30	10	10	Weights
165	***130***	***60***	***50***	***30***	***Value***

Total weighted score: 435

Data Envelopment Analysis

Data Envelopment Analysis (DEA) is used by Australia's New South Wales Treasury to monitor the performance of major government service providers, and compute the technical efficiency of the police, utilities and hospitals. It comprises both quantitative and qualitative measures. The advantage of DEA is its flexibility in the use of units of measure. The efficiency score is determined in terms of individual/organizational performance relative to the best peers. Table 4 presents the results of the application of DEA to data on five hospitals for the year 2000.

Table 4. DEA Efficiency Scores of Sampled Hospitals, 2000

Hospitals	Efficiency Scores
1	1.00
2	0.60
3	1.00
4	1.00
5	0.70

The results indicate that hospitals 1, 3 and 4 are classified as efficient, all showing a technical efficiency index of 1.00. Hospitals 2 and 5, on the other hand, have technical efficiency indexes of 0.6 and 0.7 respectively, showing that they are 40 and 30 percent less efficient respectively than the most efficient hospitals.

MALAYSIAN CUSTOMER SATISFACTION INDEX FOR THE SERVICE SECTOR FOR THE YEAR 2000: DESCRIPTION AND FINDINGS

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INTRODUCTION

The Malaysian Customer Satisfaction Index (MCSI) for the service sector is a national economic indicator comprising customer evaluations of the quality of services provided by companies and government agencies. Established for the first time in the year 2000, the MCSI is the only uniform, cross-industry measure of service quality in relation to the Malaysian economy. It provides strategic information about customer satisfaction and evaluations of service quality. Its establishment is a timely effort directed at providing consumers with information about the value of a service they purchase or use. This quality-based economic indicator adds to those that have been historically and traditionally measured, such as the Consumer Price Index (CPI), productivity, employment/unemployment, GDP, income and savings, etc., which were in existence prior to introduction of the MCSI.

THE MCSI MODEL AND METHODOLOGY

The MCSI is quite similar to the American Customer Satisfaction Index (ACSI) in terms of the econometric model but it adopts a different approach in estimating the model and the instruments used to measure customer evaluations. While the ACSI uses Partial Least Squares (PLS) for estimating the model, the MCSI incorporates a much more reliable technique called 'Generalized Maximum Entropy'. In evaluating customers' perceptions, the MCSI incorporates *service quality dimensions* that are typically unique to some types of service industry. These dimensions include the professionalism, helpfulness, timeliness, and consideration of service providers, as well as the reliability, tangibles, and confidentiality of the service(s) offered. The detailed measures are presented in the Appendix.

The MCSI methodology has four basic properties:

1. It uses an econometric model with measures of satisfaction and related constructs that are general enough to be comparable across firms, industries, and sectors. These measures come from survey questions that are inputs to the model. The relationships in the model, and the variable measures used to estimate these relationships, apply to public services and competitive product markets alike.
2. It is itself embedded in a system of cause and effect relationships. This serves to validate the index from a nomological standpoint. Nomological validity, a form of construct validity, is the degree to which a construct behaves as it should within a system of related constructs called a nomological set (Bagozzi, 1980; Cronbach and Meehl, 1955). If the model predictions are supported, then the validity of the MCSI is supported.

3. Consistent with its definition, satisfaction is measured as a latent variable (construct) using multiple indicators (questions). Any one concrete measure of satisfaction, such as a single survey question rating, is at best a proxy for latent satisfaction (Simon, 1974). Instead, the MCSI uses a variety of proxies or benchmarks that customers use to evaluate their overall consumption experience. These proxies are combined into an index to operationalize satisfaction as a latent construct.
4. The primary objective in estimating the model is to explain customer loyalty and complaints. These point to the reputation and image of the organization, which indirectly is of universal importance in the evaluation of current and future business performance.

The MCSI model is shown in Figure 1 in the Appendix.

INDEX PROPERTIES

If the MCSI is to contribute to more accurate and comprehensive measurement of satisfaction levels, impact and image, it must satisfy certain measurement requirements. These are: (1) precision, (2) validity, (3) reliability, (4) simplicity, and (5) comparability.

The MCSI is based on a tested, multi-equation econometric model. It produces a national index and indices for 14 service industries and 40 individual companies involved in providing services. The scores are on a 0-100 scale, and provide a baseline for determining whether the marketplace is becoming more or less satisfied with the quality of services provided by an individual industry or company. A high MCSI score would indicate a high level of service quality that makes customers happy. The levels of customer satisfaction are categorized as follows:

Score	Category
Between 80 and 100	Excellent
Between 70 and 80	Good
Between 50 and 70	Moderate
Less than 50	Low

Input to the model comes from data collected through personal interviews with respondents of age 18 and above, who are screened and qualified as customers of the measured companies. The MCSI is updated annually, with some new economic sectors updated each year. It was developed by AD-MACS Corp. Consultants with support from corporate sponsors.

THE FINDINGS

The results of the year 2000 evaluations of service quality in the 14 industries show that the national average level of customer satisfaction is 67.8. Table 1 gives a complete listing of the scores.

Table 1: The MCSI Averages for Service Sector Industries

Ranking	Industry	Score
1.	Hospitals	74.2
2.	Hotels	72.3
3.	Cinemas	70.8
4.	Fast Food Restaurants	70.1
5.	Cellular Phones	70.1
6.	Banks	69.5
7.	Transport	69.2
8.	Internet	69.2
9.	Government Departments	68.5
10.	Bookshops	67.2
11.	Broadcasting (Radio)	62.2
12.	Newspapers	62.0
13.	Broadcasting (TV)	61.9
14.	City Councils	61.6
	National average	**67.8**

Of the 14 industries, 35.7 percent received MCSI scores below the national average. This may be attributable to lack of concern for the welfare of consumers by service providers in these industries. The results also show that 35.7 percent of the industries are considered 'good' service providers, while 64.3 percent are considered only 'moderate' by consumers.

Private hospitals top the list of industries that provide quality services to their customers, while the hotel industry follows closely behind. The worst performance belongs to city councils, and their closest neighbor at the bottom of the scale is TV broadcasting. It seems that organizations in these two industries may have to look for better ways of serving their customers. The need for improvement in customer service should be given high priority by organizations that receive low ratings for their services.

When the score for service provision is linked with customers' expectations of service providers, the results show that the customers of city councils have low expectations of the service quality they are likely to receive from these institutions. This sentiment seems to be shared by the customers of the newspaper industry. However, in industries such as private hospitals, hotels, fast food restaurants, and cellular phones, the challenge of keeping customers happy is obvious, as the expectations of their customers regarding quality of service are relatively high compared to those in other industries.

The hotel industry and private hospitals may have something to encourage them. Their good image appears to be endorsed by their customers, at least for the time being. Their task is to sustain this image, which will require commitment and sincerity. The industries that may be likely to have loyal customers are private hospitals, hotels and fast food restaurants, which have a higher proportion of satisfied customers than the other industries included in the MCSI. On the other hand, the results indicate that unhappy and dissatisfied customers of TV broadcasting may choose to switch channels for more interesting programs. The possibility of losing customers is great if the current TV programs do not meet their expectations. In the case of city councils, customers may not have much choice even though they are unhappy with the services they receive, and the loyalty issue does not arise here. However, the tendency for them to complain about poor service is high.

An interesting aspect of the MCSI modeling is that the impact of a particular factor on another can be quantified. For instance, the findings show that satisfaction has a great impact on loyalty and image. An increase of 1 percent in customer satisfaction may lead to a 2 percent increase in customer loyalty and the image of a service provider. Studies in other countries indicate that increasing customer satisfaction may enhance the profitability and financial performance of service organizations.

QUALITY IMPROVEMENT IN SERVICE ORGANIZATIONS

For those service organizations that receive poor evaluations from their customers, the issue is how to become better service providers in the future. Studies in quality organizations show that one way to achieve a meaningful improvement is through implementation of a benchmarking program. Customer Satisfaction Benchmarking (CSB) is emerging as a critical area in the service sector and also as a decision-making tool for companies providing services. CSB is the process of continuously measuring and comparing an organization's customer satisfaction levels against those achieved by leading organizations to obtain information that will help identify ways of improving performance in this area. When properly executed in an organization, CSB is not only a tool for comparison, a learning mechanism, and a means to improvement, but also a catalyst in triggering changes in attitude and behavior towards customer satisfaction.

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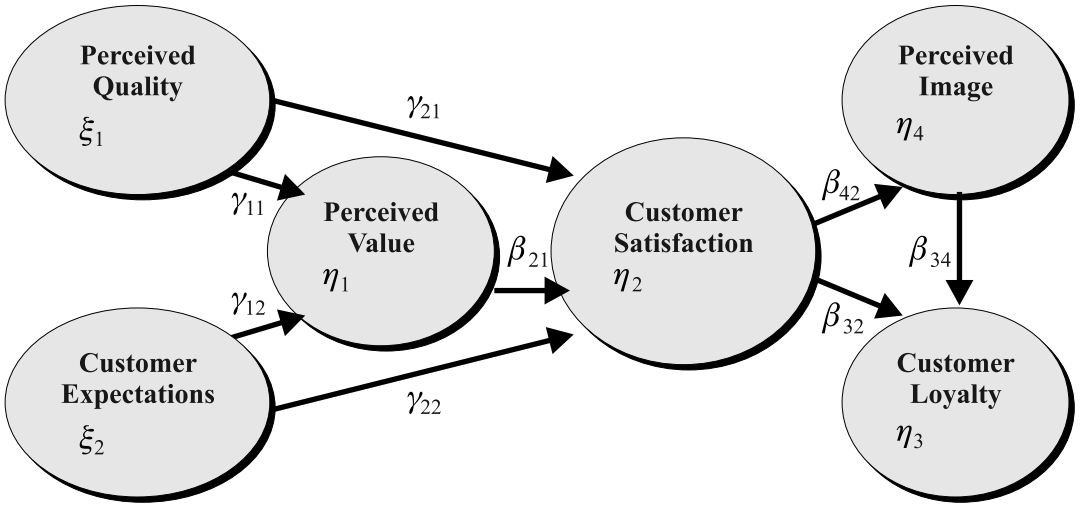
Appendix

Fig. 1: The MCSI Model



The MCSI Equations

The MCSI framework in Figure 1 can be written as the general form of Structural Equation Models (SEM). The SEM is given as

$$\eta = \beta\eta + \Gamma\,\xi + \zeta$$

where η and ξ are vectors of unobserved endogenous and exogenous variables respectively and:

β is the matrix of coefficient parameters for η ;
Γ is the matrix of coefficient parameters for ξ ; and
ζ is the disturbance term.

This implies that $E[\eta\zeta'] = E[\xi\zeta'] = E[\zeta] = 0$.

The corresponding equation that relates the latent variables in the model is:

$$\begin{bmatrix}\eta_1\\ \eta_2\\ \eta_3\\ \eta_4\end{bmatrix} = \begin{bmatrix}0 & 0 & 0 & 0\\ \beta_{21} & 0 & 0 & 0\\ 0 & \beta_{32} & 0 & \beta_{34}\\ 0 & \beta_{42} & 0 & 0\end{bmatrix}\begin{bmatrix}\eta_1\\ \eta_2\\ \eta_3\\ \eta_4\end{bmatrix} + \begin{bmatrix}\gamma_{11} & \gamma_{12}\\ \gamma_{21} & \gamma_{22}\\ 0 & 0\\ 0 & 0\end{bmatrix}\begin{bmatrix}\xi_1\\ \xi_2\end{bmatrix} + \begin{bmatrix}\zeta_1\\ \zeta_2\\ \zeta_3\\ \zeta_4\end{bmatrix}$$

where the exogenous and endogenous variables are as follows:

Exogenous Variables		Endogenous Variables	
Perceived Quality	ξ_1	Perceived Value	η_1
		Customer Satisfaction	η_2
Customer Expectations	ξ_2	Customer Loyalty	η_3
		Perceived Image	η_4

The general equations for relating the latent variables to empirical variables are:

$$y = \Lambda_y \eta + \varepsilon$$

$$x = \Lambda_x \xi + \delta$$

where y and x are the measured endogenous and exogenous variables respectively and Λ_y and Λ_x are the corresponding regression coefficients.

Assuming that there are three measured for each variable, then the corresponding equation in the model is:

$$\begin{bmatrix} \chi_1 \\ \chi_2 \\ \chi_3 \\ \chi_4 \\ \chi_5 \\ \chi_6 \end{bmatrix} = \begin{bmatrix} \lambda_1 & 0 \\ \lambda_2 & 0 \\ \lambda_3 & 0 \\ 0 & \lambda_4 \\ 0 & \lambda_5 \\ 0 & \lambda_6 \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \end{bmatrix}, \quad \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \\ y_9 \\ y_{10} \\ y_{11} \\ y_{12} \end{bmatrix} = \begin{bmatrix} \phi_1 & 0 & 0 & 0 \\ \phi_2 & 0 & 0 & 0 \\ \phi_3 & 0 & 0 & 0 \\ 0 & \phi_4 & 0 & 0 \\ 0 & \phi_5 & 0 & 0 \\ 0 & \phi_6 & 0 & 0 \\ 0 & 0 & \phi_7 & 0 \\ 0 & 0 & \phi_8 & 0 \\ 0 & 0 & \phi_9 & 0 \\ 0 & 0 & 0 & \phi_{10} \\ 0 & 0 & 0 & \phi_{11} \\ 0 & 0 & 0 & \phi_{12} \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \\ \varepsilon_7 \\ \varepsilon_8 \\ \varepsilon_9 \\ \varepsilon_{10} \\ \varepsilon_{11} \\ \varepsilon_{12} \end{bmatrix}$$

The Generalized Maximum Entropy (GME) is used to estimate the parameters of the model, i.e. β, η, Γ, and ξ respectively. The MCSI score (on a 0 to 100 scale) is then calculated using the following formula:

$$\text{MCSI} = \frac{E(\hat{\eta}_2) - Min(\hat{\eta}_2)}{Max(\hat{\eta}_2) - Min(\hat{\eta}_2)} \text{ x } 100$$

where:

$\hat{\eta}_2$ is the estimated value of η_2;

$\hat{\eta}_2$ is the estimated latent variable for Customer Satisfaction (MCSI); and

$E[\hat{\eta}_2]$, $Min[\hat{\eta}_2]$ and $Max[\hat{\eta}_2]$ denote the expected, minimum, and maximum value of the variable respectively.

The minimum and maximum values are determined by those of the corresponding manifest variables:

$$Min(\hat{\eta}_2) = \sum_{j=1}^{k} w_j \, Min(y_j),$$

and

$$Max(\hat{\eta}_2) = \sum_{j=1}^{k} w_j \, Max(y_j),$$

where y_j's are the measurement variables of the latent customer satisfaction, w_j's are the weights, and k is the number of measurement variables. In calculating the MCSI, unstandardized weights must be used if unstandardized measurement variables are used.

In the MCSI, there are three indicators (y_4, y_5 and y_6) for customer satisfaction that range from 1 to 10. Then the calculation is simplified to:

$$MCSI = \frac{\sum_{j=4}^{6} w_j \bar{y}_j - \sum_{j=4}^{6} w_j}{9 \sum_{j=4}^{6} w_j} \text{ x } 100$$

where w_j's are the unstandardized weights.

Service Quality Dimensions included in the MSCI

Dimension of service quality	Items
Helpfulness	• Helpfulness of service provider when customers need it • Willingness of service provider to co-operate with customers
Communication	• Willingness of service provider to listen to customers • Service provider keeps customers informed about progress, problems or changes
Timeliness	• Ability of service provider to deliver service within certain time • Ability of service provider to deal with customers promptly • Speed of service provider in responding to service requests
Tangibles	• Condition and appearance of facilities of service provider • Condition and appearance of written information provided by service provider • Condition and appearance of materials and products provided by service provider
Reliability	• Ability of service provider to provide necessary information • Ability of service provider to provide accurate information • Ability of service provider to provide actual service required • Ability of service provider to provide service right the first time • Extent to which service provider tries to sort problems out
Professionalism	• Skills that service provider members appear to possess to deliver service • Experience that service provider members appear to possess to deliver service • Knowledge that service provider members appear to possess to deliver service • The advice that service provider provides customers with
Confidentiality	• Service provider's handling of confidential information • The discretion the service provider displays in dealing with delicate situations
Preparedness	• Suitability of resources in the service provider to perform the service • The way the service provider is organized so as to be able to perform the service
Consideration	• Trust the service provider appears to have in customers • Understanding the service provider has of customer needs, problems and constraints • Extent to which customers can rely on the service provider's honesty

BENCHMARKING EXPERIENCES IN MALAYSIA

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INTRODUCTION

Benchmarking is a process of continuously measuring oneself against the best that can be identified in order to improve and thus achieve market superiority and a significant competitive edge. Unlike traditional competitive analysis, which focuses on outputs, benchmarking is applied to key processes within a business or organization. It relies on determining the critical success factors across the organization. Processes governing those factors are analyzed. The best performances against the key parameters are established and then used to target improvements. Only a thorough understanding of in-house processes makes it possible to recognize and integrate the differences, improvements and innovations that are found in best-practice organizations.

The benchmarking process goes beyond simply determining the performance gap between a company and its competitors. Among other things, it requires the organization to identify what it wants to improve on and continuously undertake improvement measures. Benchmarking is also a tool that can be used to identify improvement options and facilitate strategic business planning. While a business strategy can, for example, identify existing markets that offer excellent profit potential, by itself a good strategy does not guarantee success. Benchmarking - a rational, structured technique for continuously improving key business processes and practices using comparative measurement against best practice regardless of industry or location - is potentially the most powerful tool in the strategic armory.

THE BENCHMARKING CONCEPT

The Malaysian Benchmarking Service of the National Productivity Corporation (NPC) of Malaysia defines benchmarking as "a systematic and continuous process of searching, learning, adapting and implementing the best practices from within the same organization or from other organizations toward attaining superior performance." It is about searching for the best practices and learning from the best of the best to become the best in the industry.

Through benchmarking projects, participating organizations can learn together with others who are striving to overcome the same challenges as well as from best-practice 'partner' organizations. Participating organizations can not only find out where they stand but also take home proven methods for reaching high standards of excellence that can be applied to propel them towards higher level performance.

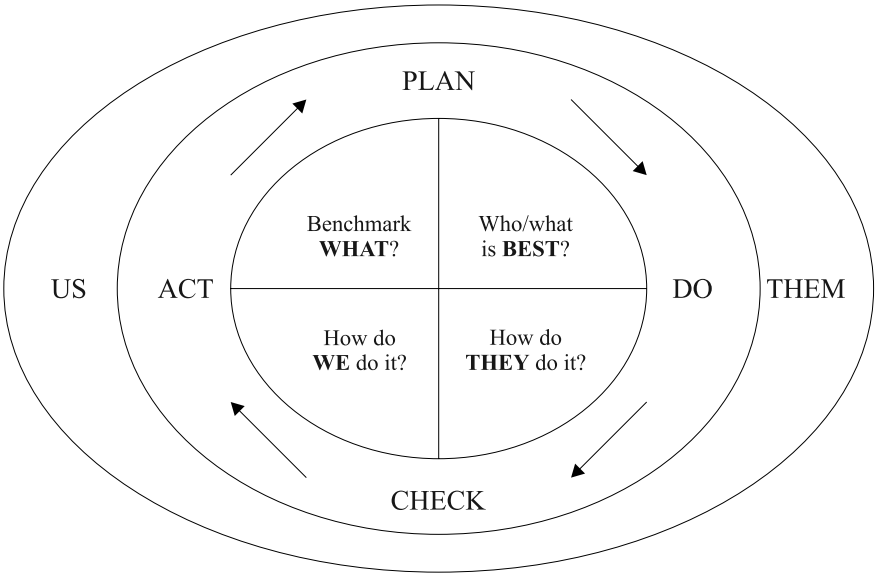
Terms that are closely associated with the concept of benchmarking are:

- ***Benchmark:*** A benchmark is a point of reference against which things are measured. These points of reference, or standards, can take many forms. They are measured by questions about the product or service (how many? how much time? how much money? how reliable? how well made is it? and so on). By studying other organizations and comparing the answers to these questions, we can measure our performance against that of others.

- ***Best practice:*** Best practice in benchmarking is a relative term indicating innovative or outstanding business practices that have been identified as contributing to significantly improved performance in leading companies. In Malaysia, leading companies can be defined as award-winning organizations frequently cited in the media for their prowess and recognition from suppliers, customers and independent bodies of reputable consultants. The idea of learning best practice is to enhance internal ability to solve problems in order to sustain competitive advantage, and to encourage or force improvement. Organizations that are strong in their given areas reveal how they arrived at that position. Looking at their philosophies, policies, approaches, data applications and training programs provides guidance to others for improving performance.

Benchmarking is not simply competitive analysis, a cost-cutting exercise, site briefings and industrial tourism, copying or playing 'catch-up', industrial espionage, or a public relations exercise. It is knowing more about our own position/operations (us) as well as those of industry leaders or competitors (them), and incorporating best practice to gain superiority. A vigorous process model that supports successful benchmarking is one that is based on the Deming cycle of *Plan-Do-Check-Act* (PDCA), as follows:

Figure 1. The Benchmarking Cycle



The cycle involves the following steps:

- ***Benchmark WHAT?***
  - ♦ Understand our own processes;
  - ♦ Identify and study the processes that are critical to results;
  - ♦ Select Key Performance Indicators (KPIs);
  - ♦ Identify potential benchmarking partners; and
  - ♦ Determine data collection elements.

- ***Who/What is BEST?***
  - ♦ Select benchmarking partners;
  - ♦ Develop data collection instruments; and
  - ♦ Conduct detailed investigations.

- ***How do THEY do it?***
  - ♦ Compare current performance with data collected to identify performance gaps;
  - ♦ Identify best practices; and
  - ♦ Develop our own practices from the 'best of breed'.

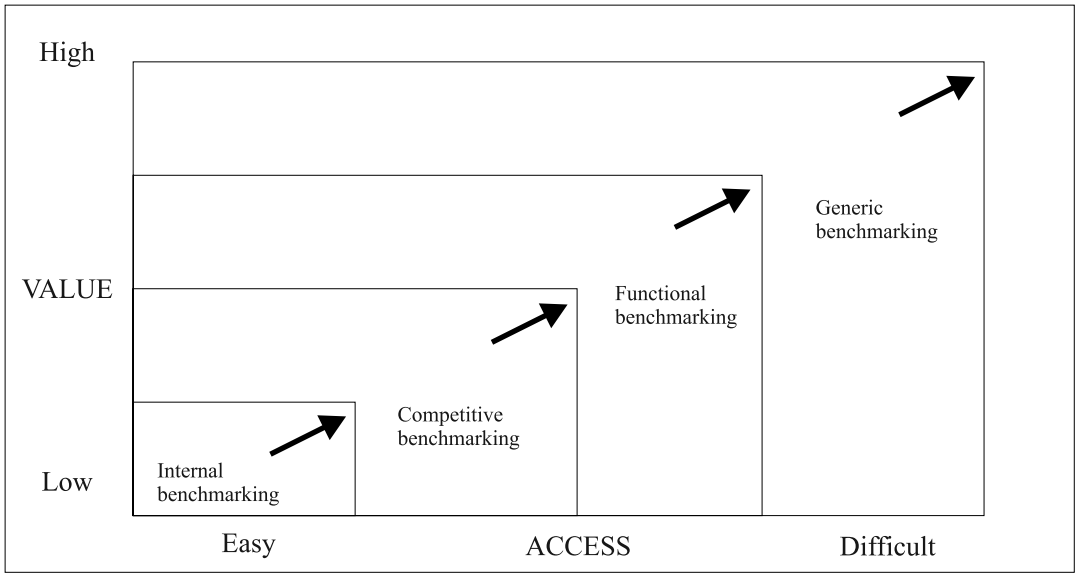
- ***How do WE do it?***
  - ♦ Communicate and gain support;
  - ♦ Implement the practices developed;
  - ♦ Monitor and report on progress; and
  - ♦ Recalibrate benchmarks and identify new opportunities.

Typically the time frame for these steps is:

- Planning the study - 30 percent;
- Collecting information - 50 percent;
- Analyzing performance gaps - 20 percent; and
- Implementing the practices developed - depends on the scope of the study.

Generally there are four types of benchmarking studies - internal, competitive, functional and generic. These involve varying degrees of difficulty and tend to yield results of varying value.

Figure 2. Types of Benchmarking



While internal benchmarking focuses on a comparison of similar operations, competitive benchmarking applies to companies that produce similar products or services. It is specific competitor-to-competitor comparison regarding the product or function in question. However, as it is usually difficult to ascertain the future plans of business rivals, competitive benchmarking may not yield information that can be used to gain a competitive advantage. Functional benchmarking, on the other hand, focuses on comparisons of similar functions within the same broad industry or with industry leaders and can lead to breakthroughs that will result in major improvements. Generic benchmarking involves comparisons of business functions or processes that are the same regardless of the industry. It can be the most informative and can result in changed paradigms in the current operations of an organization. Best-in-class companies are prime targets.

MALAYSIAN BENCHMARKING SERVICE ACTIVITIES

Having recognized the need to set up an information and reference center for benchmarking training and expertise for industries in Malaysia, the NPC set up the Malaysian Benchmarking Service (MBS) in 1997. The aim was to provide information on benchmarks and best practices through partnerships and networking. MBS also promotes benchmarking as a means of introducing substantive changes in the quest for excellence, facilitates information-sharing among companies, and provides training in benchmarking. Specifically, it provides the following services:

- Benchmarking studies for individual companies;
- Consortium benchmarking studies for groups of companies;
- Surveys on benchmarks and best practices;
- Benchmark learning expeditions;
- Benchmarking training;
- A Benchmarking On-line Networking Database (BOND) - this is a database of best practices and performance measurements set up to help organizations undertake benchmarking activities both within Malaysia and world wide; and
- Common Interest Groups (CIGs). Organizations registered with MBS are known as CIG members. CIGs are small groups of organizations that join forces to explore opportunities for benchmarking studies around common interest areas. They provide an excellent vehicle for involving the true process owners and for sharing information on best practices and processes.

Since its inception, MBS, with its networking partners, has conducted various training programs on the appreciation and application of benchmarking for enhancing organizational competitiveness. A number of benchmarking studies have also been conducted to identify best practice and to encourage the exchange of information among organizations in Malaysia. In 1998, MBS conducted a consortium benchmarking project in the area of Product Cycle Time involving ten participating organizations. In April 1999, three more benchmarking projects were launched, namely Best of the Best TQM Organizations, Human Resource Management and the Call Center project. Benchmarking projects for companies within the same industry were also conducted to identify benchmarks and best practices to be emulated among participating organizations. Such projects were conducted for the textile, construction, ports, utilities and plastics industries. Projects conducted for the public sector related to counter management and project management. Case study material is available from MBS.

The consortium benchmarking projects were undertaken with the following objectives:

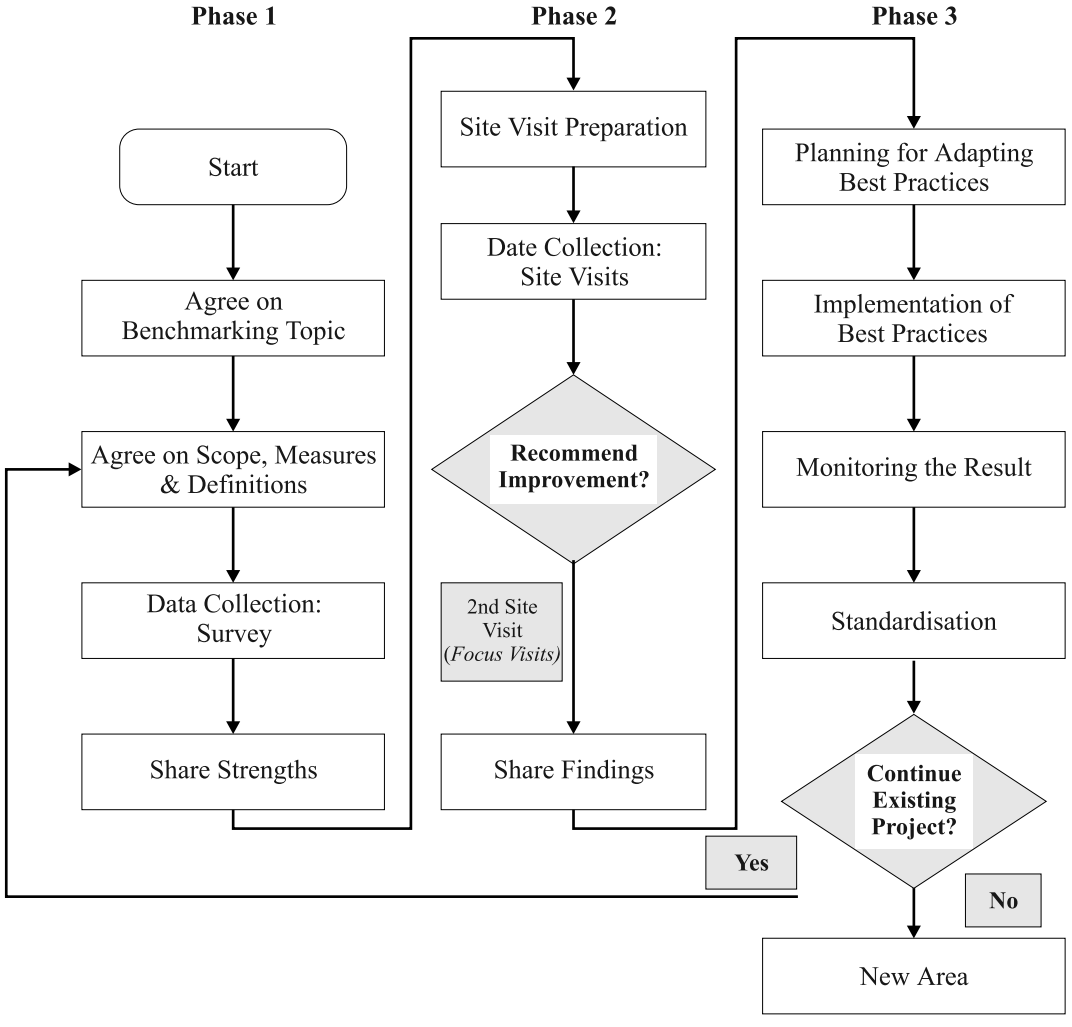
- To provide organizations with a view of the strategies, measures, and processes of the best-practice organizations in these projects;
- To upgrade best practice information for BOND;
- To facilitate information sharing and benchmarking activities for companies in Malaysia; and
- To realize some of the recommendations put forward by the National Economic Action Council (NEAC) to accelerate the economic growth of the nation.

These activities were carried out using the model designed by NPC based on the requirements of industries in the country.

The NPC Benchmarking Model

Benchmarking can be undertaken as a structured process and this structure is best provided by the development of a step-by-step model. There are a number of such models that vary in complexity from four to thirty steps. However, no matter what terms they use, close scrutiny reveals that they all revolve around four basic stages or phases: planning, data collection, data analysis and action. The NPC Benchmarking Model described here is a synthesis of these various models. It incorporates all the steps that have been found to characterize successful benchmarking programs in leading organizations. The model is outlined in Figure 3.

Figure 3. The NPC Benchmarking Model



The model comprises 14 steps arranged in three phases. The first two phases are for planning and analysis. The third phase is for action or implementing the best practices identified. The final phase embraces reviewing the benchmarking project. It is important to note that, in the model, constant monitoring and feedback take place throughout the benchmarking process. The model is consistent with various definitions of benchmarking, including benchmarking as a continuous process. As such, it follows the PDCA cycle.

Phase 1

The 'Plan' phase focuses on the various up-front decisions that need to be made, such as the selection of functions/processes to benchmark and the type of benchmarking study to be undertaken. Participating organizations are involved in self-study to characterize the selected processes using matrices and to document their business practices. A strength-sharing session is held to enable them to learn, comparatively speaking, in which particular areas they can improve and also to identify those partners who have already grappled with, and overcome, similar problems and are willing to share their ideas.

Phase 2

Phase two involves training the benchmarking teams in each of the organizations to equip them with the necessary skills and knowledge. They are not only responsible for investigating improvement opportunities but also organize site visits to the best practice performers in the particular processes they have selected. Each team is required to report its findings as to whether negative or positive gaps exist between their organization and its benchmarking partner(s). They then proceed to recommend actions to close negative gaps or maintain positive ones.

Phase 3

In this phase MBS facilitates organizations' adaptation and implementation of the best-practice findings arising from their benchmarking projects. The key skill here is change management. Improvement teams are trained to ensure constant monitoring and measurement of results to determine whether improvement is taking place. Regular reviews of contingency plans and deadlines along with documentation of progress are essential to maintain momentum.

The NPC Benchmarking Model provides an adequate framework for the successful planning and execution of a benchmarking exercise. It enables companies to see where they are going and how they are going to get there. It also provides a common process and a language that is understandable to all. Since the model provides the basic framework for action, all types of variations are possible within it and the process can be tailored to fit the specific requirements of individuals, groups and organizations. The outputs resulting from the various process steps are listed in Table 1.

Table 1. Benchmarking Project Outputs

Benchmarking Process		Outputs
1st Meeting	Agree on benchmarking topic	• Awareness of benchmarking study • Understanding of key issues related to benchmarking topic
2nd Meeting	Agree on scope; measures and definitions	• Key questions of benchmarking study established • Benchmarking methodology learned
3rd Meeting	Data collection: survey	• Review of own processes
4th Meeting	Share strengths	• In-depth key findings discussion
5th Meeting	Site visit preparation	• Key questions established for site visit 1 • Benchmarking team trained
6th Meeting	Data collection: Site visit 1	• Learning from face-to-face interviews • Hands-on-experience
7th Meeting	Recommend improvements	• Report 1
5th Meeting ®	Site visit preparation	• Focus questions established for site visit 2
6th Meeting ®	Data collection: Site visit 2	• Learning from face-to-face interviews • Hands-on-experience
7th Meeting ®	Recommend improvements	• Report 2
8th Meeting	Share findings	• In-depth key findings discussion • Benchmarking partners' presentations

Note: ® = Repeat

Benchmarking Code of Conduct

To guide benchmarking encounters, advance the professionalism and effectiveness of the practice, and protect practitioners, a code of conduct has been adopted by MBS. It concerns the principles of:

- Legality;
- Exchange;
- Confidentiality;
- Use;
- Contact;
- Preparation;
- Completion; and
- Understanding and action.

In benchmarking with competitors, it is particularly important to establish specific ground rules up front, e.g. "We don't want to talk about things that will give either of us a competitive edge".

BENCHMARKING PRACTICES AMONG MALAYSIAN COMPANIES

In January 1998, NPC conducted a study to gauge the level of benchmarking practices among organizations in Malaysia. Seventy organizations registered with MBS were invited to participate in the study and 36 (51.0 percent) responded. Fifteen organizations (41.7 percent) reported that there was a structure for benchmarking in their organizations, whilst 21 organizations (58.3 percent) said that there was no such structure.

A total of 22 organizations or 61.1 percent indicated that there were no established roles for senior management in their organizations' benchmarking processes, whereas nine organizations (25.0 percent) indicated that one existed. When asked whether they had started conducting any benchmarking studies, 20 organizations (55.6 percent) reported that their organizations had conducted benchmarking studies and 16 organizations (44.4 percent) said they had not.

The types of benchmarking studies conducted were as follows:

- Internal benchmarking - 63.7 percent;
- With other organization(s) - 45.0 percent;
- With one or more organizations in their industry/field - 40.9 percent;
- With another organizations recognized as 'Best-In-Class' - 31.8 percent; and
- Invited to participate in benchmarking (recognized as 'Best-In-Class') - 13.6 percent.

Most organizations cited insufficient benchmarking skills (66.7 percent) and insufficient experience as the major constraints in initiating benchmarking activities in their organizations. Other constraints included lack of trained personnel (47.2 percent), a limited budget (30.6 percent) and top management commitment (13.9 percent). Low priority as a constraint in initiating benchmarking activities was registered by only 11.1 percent of organizations.

In 63.6 percent and 51.5 percent of cases respectively, Total Quality Management and ISO 9000 initiatives had been the factors most directly contributing to decisions by organizations to participate in benchmarking projects. A further 45.5 percent reported business process re-engineering as a contributing factor and 33.3 percent national quality awards. Apart from this, 55.6 percent mentioned that they had a directory or database of potential benchmarking partners.

The respondent companies stated that the major areas in which they had been benchmarked by others were:

- Human resource management - 43.5 percent;
- Employee recognition - 34.8 percent;
- Performance evaluation - 30.4 percent;
- Cost control - 21.7 percent;
- Customer service - 21.7 percent;
- Project improvement - 17.4 percent; and
- Inventory control - 8.7 percent.

The findings showed that 38.9 percent or 14 organizations were currently undertaking a benchmarking study whilst 33.3 percent or 12 organizations indicated otherwise. The organizations participating in this study also reported that they had experienced some improvement as a result of their benchmarking efforts in the areas shown in Table 2.

Table 2. Areas of Improvement in Benchmarking Projects

Areas	Very Little Improvement (%)	Little Improvement (%)	Some Improvement (%)	Great Improvement (%)	Very Great Improvement (%)
Product/Service quality	14.3	-	57.1	28.6	-
Cycle time of operations	6.7	6.6	40.0	46.7	-
Increased productivity	6.2	12.5	43.8	37.5	-
Reduced costs	6.2	12.5	56.3	12.5	12.5
Customer service	-	12.5	62.5	25.0	-
Customer satisfaction	6.2	-	50.0	43.8	-
Profits	18.8	12.5	25.0	37.5	6.2

The findings showed that the cycle time of operations, customer satisfaction and profits were the three major areas showing the greatest improvements.

This study suggests that benchmarking is still relatively new among organizations in Malaysia. The benchmarking practiced is mostly internal, carried out within the same organization. The area of human resources dominated the study. This included human resource management, employee recognition and performance evaluation, which respectively constituted 43.5 percent, 34.8 percent and 30.4 percent of benchmarking efforts. The lack of staff skilled, experienced and trained in benchmarking limited the companies' ability to further propagate and practice this concept rather than top management support or budget constraints.

CONCLUSION

Benchmarking, if properly implemented, can help resolve problems by forcing an organization to compare itself with best-in-class organizations, quantifying the differences in performance, documenting why the differences exist and identifying what to do to become as good as, and eventually better than, these organizations.

To achieve its vision with the help of benchmarking, an organization needs to understand the critical success factors for the benchmarking process. These are:

- Conducting the right study;
- Being committed to implementing the results;
- Using an appropriate benchmarking process;
- Choosing and empowering the right team members;
- Knowing its own processes first;
- Adhering to the code of conduct;
- Testing the adaptability of practices and enablers; and
- Verifying the results of implementation.

Even then, success will not be achieved without:

- The full support of senior management;
- Incorporation of the practice in organizational strategy;
- Implementation as a team activity; and
- Planned and organized execution.

While benchmarking is not the answer to all problems, it does provide the following benefits:

- It ensures that best practices are identified, which in turn ensures that appropriate improvement targets are set;
- It provides a deep understanding of the organization's processes;
- It helps overcome disbelief in outside practices and convinces an organization that it can improve on them;
- It counters reluctance to try something different and stimulates innovations and breakthroughs;
- It helps identify new technologies that may have started in other industries, e.g. bar-coding;
- It redirects the focus of an organization, helping it to turn outwards and thus see 'outside the box'; and
- It is a practical tool for continuous improvement.

The globalization and liberalization of the world economy poses new challenges. Companies in Malaysia must be equipped to compete and win. Benchmarking will help to create a sense of urgency by telling them where they are, how good they have to be, and what they have to do to get there. The ultimate objective is to improve productivity and quality and enhance national competitiveness.

REPUBLIC OF CHINA

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TOTAL FACTOR PRODUCTIVITY GROWTH IN THE REPUBLIC OF CHINA'S SERVICE INDUSTRY, 1962-96

The service industry is the biggest sector in Taiwan, in terms of either a broad or narrow definition. Broadly defined, the service industry is Gross Domestic Product (GDP) minus the agriculture and industry sectors and accounted for 62.96 percent of GDP in Taiwan by 1998. Even according to a narrow definition, by which it includes only finance; insurance; real estate; business services; community, social and personal services; retailing; wholesaling; trade and eating/drinking places, it accounted for 49.02 percent of Taiwan's GDP in 1998.

The average annual growth rate of value added in the service industry was 9 percent according to the broad definition and 9.98 percent in terms of the narrow definition in 1962-96, and both surpassed the GDP growth rate (8.66 percent) during that period.

The purpose of this paper is as follows:

- To analyze the sources of growth in Taiwan's service sector in terms of its narrow definition during the period 1962-96;
- To measure the growth of total factor productivity (TFP) in the service sector during the same period;
- To compare the estimated TFP results derived by employing one approach that considers quality changes in factor inputs and a second approach that does not consider such changes (a commonly used method); and
- To identify the causes of TFP growth in Taiwan's service sector.

In calculating TFP, both approaches used are derived from growth accounting and are developed from a translog[2] production function, which is more generalized than the conventional Cobb-Douglas and CES production functions.

METHODOLOGY

Following Gollop and Jorgenson (1980), sectoral productivity is measured in this paper using the translog production function: Value Added (Q) is a function of the logarithms of capital (K), labor (L) and time (T) which indexes the level of technology. The production function is assumed to be constant returns to scale, so that a proportional change in all inputs results in a proportional change in value added[3].

[1]The author would like to thank his assistant, Ting Lie, for her help with the calculations.
[2]Christensen, Jorgenson and Lau (1970) introduced the translog function, which is a second-order approximation of constant elasticity of substitution like the Cobb-Douglas and CES.
[3] See Gollop, F., and D. W. Jorgenson (1980).

If we consider data at any two discrete points in time, say T and $T-1$, the average rate of technical change or TFP changes can be expressed as the successive logarithms of value added minus successive logarithms of capital and labor with weights given by average value shares[4]:

$$\overline{R}_T = \ln Q(T) - \ln Q(T-1) - \overline{S}_K[\ln K(T) - \ln K(T-1)] - \overline{S}_L[\ln L(T) - \ln L(T-1)] \quad (1)$$

where

$$\overline{S}_i = \frac{1}{2}\,[S_i(T) + S_i(T-1)] \quad , \quad i = K,L$$

We refer to this expression for the average rate of technical change,as the translog index of the rate of technical change or the translog index of the rate of TFP change. The translog index is sometimes called the discrete version of the Divisia index or Tornqvist index[5]. Diewert has shown that if the production function is a homogeneous translog, then the translog index will be exact. This provides a theoretical foundation for using the translog index in productivity analysis.

For considering quality changes in factor inputs, we can consider specific forms for the functions defining industry aggregate capital (K) and labor (L). For example, the capital aggregate can be expressed as a translog function of its individual component of capital.

Considering the data at discrete points in time, the difference between successive logarithms of capital is a weighted average of differences between successive logarithms of individual capital, and the weights are given by average value shares:

$$\ln K(T) - \ln K(T-1) = \sum_{i=1}^{k} \overline{S_{K_i}}\,[\ln K_i(T) - \ln K_i(T-1)], \quad (2)$$

where

$$\overline{S_{K_i}} = \frac{1}{2}\,[S_{K_i}(T) + S_{K_i}(T-1)], \quad (i = 1,2,...,k) \quad (3)$$

Similarly, if aggregate labor is the translog of its components, we can express the difference between successive logarithms in the form:

$$\ln L(T) - \ln L(T-1) = \sum_{i=1}^{l} \overline{S_{L_i}}\,[\ln L_i(T) - \ln L_i(T-1)], \quad (4)$$

where

$$\overline{S_{L_i}} = \frac{1}{2}\,[S_{L_i}(T) + S_{L_i}(T-1)], \quad (i = 1,2,...,l) \quad (5)$$

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[4] See Gollop-Jorgenson (1980). For proof, see Diewert (1976).

[5] See Berndt (1980) and Diewert (1976).

DATA COMPILATION AND SOURCES

The observation period runs from 1962 to 1996. The service sector, by narrow definition, includes: finance; insurance; real estate; business services; community, social and personal services; trade and eating/drinking places.

Capital Input

Capital input is decomposed into six categories:

1. Building (K_1);
2. Other building (K_2);
3. Transportation equipment (K_3);
4. Machinery (K_4);
5. Inventory (K_5); and
6. Land (K_6).

A perpetual inventory approach is employed to estimate the capital stock. Various types of capital stock come from the National Wealth Censor, the Industry and Commercial Censor and the Directorate General of Budget, Accounting and Statistics (DGBAS), Executive Yuan. Except for land (K_6), all types of capital are calculated by adding up the corresponding net capital formation, which is the difference between gross capital formation and depreciation, starting from 1951. The gross capital formation during 1951-1989 comes from the DGBAS, while the types of depreciation are compiled by employing the constant rate depreciation method and year of depreciation listed in the National Wealth Censor (1988). The time series capital stock during 1961-89 is then calculated by adding up the net capital formation starting from 1951 - the first year of the National Income Account in Taiwan. This method implicitly assumes that there was no net capital stock existing before 1951. The land data comes from the Industrial and Commercial Censor for various years. Finally, we adjust the series data of capital stock by employing the National Wealth Censor (1988) except for land and inventory.

To calculate S_{K_i} in equation (2), we need not only the quantity data of K_i, but also the price data of P_{K_i}, i.e. i type of capital service price. The types of capital service prices are compiled by using the following equation from Christensen-Jorgenson (1970):

$$P_{K_i} = \frac{1-\mu(T)\cdot Z_i(T)}{1-\mu(T)}\ [P_{I_i}(T-1)\cdot(1-\mu(T))\cdot R_r(T) + \delta_i \cdot P_{I_i}(T) - (P_{I_i}(T) - P_{I_i}(T-1))]$$

$$+ P_{I_i}(T)\cdot \tau_i(T), \quad (i = 1,2,3,4,5,6) \qquad (6)$$

where

$\mu(T)$ is the effective business income tax rate;
$Z_i(T)$ is the present value of depreciation deduction on one dollar of investment;
$P_{I_i}(T)$ is the price index of gross investment of type I;
δ_i is the depreciation rate;
$\tau_i(T)$ is the property tax rate of capital of type I; and
$R_r(T)$ is the nominal rate of return.

The effective business income tax rate is the ratio of business income tax to the total profit of all sectors. The data on business income tax comes from the yearbook of the Ministry of Finance. The total profit of all sectors (excluding interest and rent) is taken from the National Income Account.

Employing the constant rate of depreciation method, the present value of deduction on one dollar of investment is calculated by means of the following equations:

$$Z_i(T) = \sum \left[\frac{(1-\delta)^{\omega-1} \cdot \delta}{(1+r)^{\omega}} \right]$$

$$\delta = 1 - \left(\frac{s}{c}\right)^{\frac{1}{N}} \quad (\text{given } s = 0.1c) \tag{7}$$

where

N is the time span of investment goods;
δ is the constant rate of depreciation;
r is one year primary interest rate;
c is the cost of investment goods; and
s is the remaining value of investment goods.

The data on N and r come from the National Wealth Censor (1988) and Financial Statistics Monthly, respectively. The deflator of type I for each sector capital is the quotient of the gross capital formation at current prices and the gross capital formation at constant (1986) prices. Both are provided by the Statistics Bureau of DGBAS.

Based on the corresponding tax code, property tax ($Z_i(T)$) on construction (K_1) and miscellaneous construction (K_2) is assumed to be 3.0 percent. That for land (K_6) is assumed to be 1.5 percent. There is no property tax on machinery (K_4) and inventory (K_5).

The property tax rate on transportation equipment (K_3) is calculated as follows:

$$K_3 = \frac{\textit{The license revenue from mobile cars}}{K_3 \textit{ at current price + the value of the transportation equipment of all residents}} \tag{8}$$

The internal rate of return ($R_r(T)$)is calculated by means of the following equation:

$$R_r(T) = \frac{PC - \sum_{i=1}^{6} \left[\frac{1-\mu(T)\cdot Z_i(T)}{1-\mu(T)} \quad \delta \cdot P_{I_i}(T) - P_{I_i}(T) \right]}{\sum_{i=1}^{6} [1-\mu(T)\cdot Z_i(T)]\, P_{I_i}(T-1)\, K_i(T)} \tag{9}$$

where PC denotes property compensation, which is the sum of rent, interest, and profit depreciation, and which equals the summation of the products of K_i and P_{K_i}:

$$PC = \sum_{i=1}^{6} P_{K_i} \quad K_i(T-1) \tag{10}$$

The data on property compensation (PC) as well as the share of capital (S_K) by sector come from the GDP and Factor Income by Sector figures, as released by the Statistics Bureau, DGBAS.

Labor Input

Labor is classified into four groups: managers and clerks; engineers and technicians; skilled labor; and unskilled labor. The data for aggregate quantity of labor input is provided by the DGBAS. The structure of labor input, classified by the four types, is derived by interpolating the Industrial and Commercial Census data for 1961, 1966, 1971, 1976, 1981, 1986, and 1991.

The data for the breakdown of labor compensation before 1976 were compiled by:

- Interpolating the Census data for 1961, 1966, 1971, 1976, 1986, 1991 and the 1992 Labor Statistics Monthly data to get a preliminary estimate of four types of wages P_{L_i};
- Adjusting P_{L_i} with information from *Adjustment of the Manufacturing Wage Statistics in Taiwan Area* to obtain P_{L_i}';
- Multiplying L_i by P_{L_i}' to obtain labor compensation $L_i P_{L_i}'$;
- Adjusting labor compensation $L_i P_{L_i}'$ using information from the National Income Account to obtain adjusted labor compensation; and
- Using adjusted labor compensation and L_i to obtain the wage rate P_{L_i}.

The breakdown of labor compensation data after 1976 is from DGBAS. The value and the value share of labor compensation in total output come from the National Income Account.

Value Added

Value added is the difference between total output and intermediate input. The time series value added at constant 1986 prices in the service sector as a whole during 1962-1996 comes from DGBAS.

EMPIRICAL RESULTS

The Growth of Value Added and Input

For the purposes of understanding the trend in TFP growth, the study period 1962-96 is categorized into four sub-periods, i.e. 1962-73, 1973-82, 1982-87 and 1987-96. The 1973-82 period, characterized by two oil crises, was different from 1962-73. During 1982-87, the price of oil fell from US$34.0 to US$16.0. The high appreciation of the new Taiwan (N.T.) dollar against the U.S. dollar immensely affected the restructuring of Taiwan's economy during the 1987-96 period. The growth of value added and input are presented in Table 1. Three important conclusions emerge from this table:

1. The real value added of the service industry registered a growth rate of 11.39 percent per annum during 1962-73[6]. The growth rate fell to 8.83 percent per annum during the oil crisis period (1973-82) then rebounded to 10.31 percent during 1982-87. During 1987-96, the high appreciation of the NT dollar and the surge in wages and real estate prices had a negative impact on the growth of the service industry. However, this was largely offset by the liberalization policy of the finance and insurance sectors starting from 1988. Hence, the value added growth rate only slightly decreased to 9.22 percent per annum. Liberalization Acts that allowed new entrants were promulgated in May 1988, April 1990 and June 1992 for stock brokerage houses, banks, and insurance companies respectively. The number of stock brokerage houses surged from 104 in 1988 to 648 in 1996, and that of commercial banks from 4,300 in 1990 to 5,694 in 1996. The number of insurance companies rose from 45 in 1992 to 63 in 1996. For the whole observation period (1962-96), the value added growth of the service sector averaged 9.98 percent per annum. (For annual data on value added growth, refer to Appendix 1, column 2.)

[6] To comply with the TFP calculation, the value added growth rate is calculated by taking the logarithmic difference of value added between two successive periods *t* and *t-1*.

2. In the service industry, the capital input grew at 10.70 percent per annum during the 1962-96 period. The annual rate of increase was 13.21 percent per annum during 1962-73, 10.49 percent during 1973-82, 5.51 percent during 1982-87 and 10.72 percent during 1987-96. (For annual data on capital growth, refer to Appendix 1, column 6.)
3. Labor input increased at a much lower rate than capital input. In the service industry it grew by 5.19 percent per year in the 1962-96 period. The rate of increase declined from 6.24 percent in 1962-73 to 4.20 percent during 1973-82. It rebounded to 5.31 percent during 1982-87, then slightly decreased to 4.83 percent during 1987-96. (For annual data on labor growth, refer to Appendix 1, column 10.)

The Growth of TFP

From 1962 to 1996, the TFP growth of the service sector was estimated at 2.73 percent per annum, if quality changes in factor inputs are taken into consideration. It averaged 2.25 percent in 1962-73, and was 2.26 percent during the oil crisis period of 1973-82. It rebounded to 5.0 percent in 1982-87 and then slipped to 2.52 percent in 1987-96. (For annual data on TFP growth, refer to Appendix 1, column 13.)

The Sources of Growth

The sources of growth in Taiwan's service sector during 1962-96 are set out in Table 2. Four important conclusions can be drawn:

1. Capital input accounted for 40.32 percent of value added growth during the period 1962-96. Labor accounted for 32.32 percent. TFP contributed the least at 27.36 percent of value added growth during the period.
2. The rapid growth of capital accumulation played an important role not only in Taiwan's service sector but also the growth of the whole economy, largely due to the high savings ratio in 1962-96. The savings/GDP ratio averaged a high 28.64 percent during this period. This can be attributed to:

    - The influence of Confucian culture, in which frugality is considered an important virtue;
    - Positive real interest rates that encouraged savings (the growth in the Consumer Price Index averaged 5.25 percent, and the nominal, one year deposit, interest rate fluctuated between 6.25 percent and 14.5 percent);
    - Incentives provided by tax law (interest and dividend incomes up to N.T.$350,000 were tax-exempt before 1991, and N.T.$270,000 afterwards); and
    - High GDP growth rates that generated an increasing savings ratio.

3. The contribution of TFP to value added growth surpassed that of capital input during 1982-96. TFP became the most important source of value added growth. Its share surged from 22.03 percent in 1962-82 to 35.46 percent in 1982-96. The contribution of labor increased slightly from 31.75 percent in 1962-82 to 33.20 percent in 1982-96. In contrast, the contribution of capital dropped from 46.22 percent in 1961-82 to 31.35 percent in 1982-96.

4. TFP played an increasingly important, even dominant, role in explaining the value added growth of Taiwan's service industry during the 1982-1993 period. This industry-level finding reinforces the argument of Liang (1995) and Liang (1998) that Krugman's hypothesis - the fast growth of Newly Industrialized Economies has little to do with TFP growth - is invalid since growth in the last decade reveals the future trend of TFP's contribution to Taiwan's economic growth.

Comparison of TFP with and without Considering Input Quality Changes

It should be noted that the TFP figures set out above, as measured by means of equations (1) to (5), take input quality changes into account. Conversely, the commonly used TFP growth calculation that uses equation (1) alone does not take such changes into consideration. Hence, it is interesting to compare the TFP figures that consider input quality changes with those that do not. TFP growth as derived by the commonly used calculation method is presented in Table 3.

The TFP growth of the service sector with input quality changes taken into consideration is estimated at 2.73 percent per annum during 1962-96, as compared with 3.64 percent when input quality changes are not taken into account. For the periods 1962-73, 1973-82, 1982-87, and 1987-96, the TFP growth figures without considering input quality changes are 3.16 percent, 2.75 percent, 6.39 percent and 3.56 percent respectively. When input quality is taken into consideration, the figures are 2.25 percent (1962-73), 2.26 percent (1973-82), 5.00 percent (1982-87) and 2.52 percent (1987-96). Thus we can see that there is a notable difference. Since the contribution of input quality changes toward value added growth should be attributed to inputs instead of TFP, it is vital to take input quality changes into consideration when calculating TFP growth.

Regression Analysis on TFP Changes

According to Liang (1995), the acceleration of TFP growth for the economy as a whole in Taiwan between 1962 and 1996 can be attributed to eight potential factors:

- Industrial structure changes;
- Currency appreciation;
- Infrastructural investment;
- Education of the labor force;
- Research and development expense (R&D);
- The openness of the economy;
- A reverse brain drain; and
- Foreign investment.

Here we apply regression analysis to test the effect of the above eight factors on TFP growth in Taiwan's service industry. Employing the time series data for 1970-93, a simple regression analysis of TFP growth was conducted on changes in the above factors as follows:

$$\ln TFP = a + \beta \ln X_i$$

where X_i is explanatory variables, which include:

- Industrial structure changes: value added of heavy industry/value added of manufacturing;
- Currency appreciation: NT$/US$;
- Foreign investment: foreign investment approved/GDP (%);
- Infrastructural investment (GVUT): Gross Capital Formation in the government and utility sectors (NT$);
- The openness of the economy (ImExp): the percentage of exports plus imports in GDP (%);
- Gross Fixed Capital Formation (GCF): NT$ 10 million (at 1991 prices);
- Education: labor employed with education levels above senior high school/total labor (%);
- Gross Domestic Product (GDP): million NT$ (at 1991 prices);
- Reverse brain drain (SCINUM): Returnees from abroad with science and engineering degrees (persons);
- Wage rate: NT$ per month; and
- R & D: R & D/GDP (%).

The simple regression results of TFP on the above factors are presented in Table 5. From Table 5, the following important conclusions emerge:

1. At a significant level of 0.05, all of the t values of the above factors are significant, i.e. greater than 1.96, except for foreign investment and the openness of the economy.
2. The adjusted R-square ranges from 0.68 to 0.93 in all simple regression results except for foreign investment and openness of the economy.
3. 1. and 2. imply that the TFP growth of Taiwan's service sector was affected by the following important factors: (a) wage increases; (b) education of the labor force; (c) R&D; (d) gross capital formation; (e) a reverse brain drain; (f) infrastructural investment; and (g) currency appreciation.
4. From the regression analysis, neither foreign investment nor the openness of the economy are considered significant factors in the acceleration of TFP growth between 1962 and 1996.

Because the high degree of multi-colinearity led to a poor outcome of the multiple regression result, it is not presented here.

CONCLUSIONS

This paper measures the TFP growth in Taiwan's service sector during the period 1962-96. The main findings are as follows:

1. The TFP growth rate in Taiwan's service sector was an average of 2.25 percent in 1962-73. It rose slightly to 2.26 percent during the oil crisis period of 1973-82, increased to 5.00 percent in 1982-87 and dipped to 2.52 percent in 1987-96.
2. Capital input accounted for 40.3 percent of value added in the service sector growth rate (10.70 percent) in 1962-96. Next was labor, accounting for 32.32 percent. TFP was the smallest contributor, accounting for 27.36 percent of value added growth in the service sector during the 1961-96 period.
3. The rapid growth of capital accumulation, which has played an important role in the economic growth of the Republic of China, is largely due to the high savings ratio in the 1962-96 period. The savings/GNP ratio averaged 28.64 percent in 1961-96. This may be attributed to: (a) the influence of Confucian culture; (b) positive real interest rates; (c) incentives provided by tax law; and (d) the high GNP growth rate.

4. The contribution of TFP to value added growth in the service sector surpassed that of capital input in 1982-96, becoming the most important source of such growth. The contribution of TFP to value added growth in the sector surged from 22.03 percent in 1962-82 to 35.46 percent in 1982-96. In contrast, the contribution of capital fell from 46.22 percent in 1962-1982 to 31.35 percent in 1982-96.
5. TFP growth in the service sector, as calculated without considering input quality changes, was 3.64 percent in 1962-96. This differs from the figure obtained when input quality changes are considered (2.73 percent). Since the contribution of input quality changes to value added growth should be attributed to input instead of TFP, it is vital to take input quality changes into consideration when calculating TFP growth.
6. The regression analysis indicates that TFP growth in Taiwan was affected by seven important factors: (a) wage increases; (b) education of the labor force; (c) R&D; (d) gross capital formation; (e) a reverse brain drain; (f) infrastructural investment; and (g) currency appreciation.

Table 1. Growth of Value Added, Input, & TFP in Taiwan's Service Industry, 1962-96 (%) (Input quality changes considered*)*

	1962-96	1962-82	1982-96	1962-73	1973-82	1982-87	1987-96
Growth of value added	9.98	10.24	9.61	11.39	8.83	10.31	9.22
Growth of input							
• Capital input	10.70	11.98	8.86	13.21	10.49	5.51	10.72
• Labor input	5.19	5.32	5.00	6.24	4.20	5.31	4.83
Growth of value added							
• TFP	2.73	2.26	3.41	2.25	2.26	5.00	2.52

Note: Transportation, communication and government non-profit institution sectors are not included.

Table 2. Sources of Growth in Taiwan's Service Industry, 1962-96 (%) (Input quality changes considered)

Relative contribution to value-added growth	1962-96	1962-82	1982-96	1962-73	1973-82	1982-87	1987-96
• Capital input	40.32	46.22	31.35	47.12	44.79	18.49	39.33
• Labor input	32.32	31.75	33.20	33.09	29.63	32.99	33.32
• TFP	27.36	22.03	35.46	19.79	25.58	48.52	27.34

Note: See Table 1.

Table 3. Growth of Value Added, Input, & TFP in Taiwan's Service Industry, 1962-96 (%) (Regardless of input quality changes)

	1962-96	1962-82	1982-96	1962-73	1973-82	1982-87	1987-96
Growth of value added	9.98	10.24	9.61	11.39	8.83	10.31	9.22
Growth of input							
• Capital input	9.25	9.83	8.42	11.03	8.35	4.79	10.44
• Labor input	4.67	5.55	3.41	6.25	4.70	3.52	3.34
Growth of value added							
• TFP	3.64	2.98	4.57	3.16	2.75	6.39	3.56

Note: See Table 1

Table 4. Sources of Growth in Taiwan's Service Industry, 1962-96 (%) (Regardless of input quality changes)

Relative contribution to value-added growth	**1962-96**	**1962-82**	**1982-96**	**1962-73**	**1973-82**	**1982-87**	**1987-96**
Capital input	34.62	37.80	29.78	39.19	35.62	16.04	38.31
Labor input	28.96	33.10	22.65	33.04	33.19	21.96	23.07
TFP	36.42	29.10	47.57	27.77	31.19	62.00	38.62

Note: See Table 1.

Table 5. Simple Regression Results on Changes in TFP (1970-93) ($\ln TFP = a + b \ln X_i$**)**

		Coefficients										
		Model (1)	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**	**Model (7)**	**Model (8)**	**Model (9)**	**Model (10)**	**Model (11)**
	Constant	5.22 (7.75)*	0.51 (9.66)*	-2.01 (-9.46)*	-1.93 (-1.16)	-3.07 (-13.29)*	-1.54 (-11.51)*	-4.06 (-14.04)*	-1.57 (-7.70)*	-2.18 (-13.57)*	-10.63 (-6.86)*	0.59 (35.13)*
Model (1)	Exchange rate (NT$/US$)	-1.33 (-7.03)*										
Model (2)	Foreign investment/ GDP		-0.21 (-1.67)									
Model (3)	Government & utility investment			0.34 (11.82)*								
Model (4)	Openness of economy {(Export+Import) /GDP}				0.55 (1.45)							
Model (5)	GCF					0.42 (15.46)*						
Model (6)	Employees with educational level above senior high						0.60 (15.30)*					
Model (7)	GDP							0.29 (14.81)*				
Model (8)	Reverse brain drain (no. of returnees with scientific degrees)								0.34 (10.26)*			
Model (9)	Wage rate									0.30 (16.81)*		
Model (10)	Share of heavy industry in manuf. GDP										2.87 (7.19)*	
Model (11)	R & D expense**											0.63 (11.24)*
R^2		0.69	0.11	0.86	0.09	0.92	0.91	0.91	0.83	0.93	0.71	0.90
Adj. R^2		0.68	0.07	0.86	0.05	0.91	0.91	0.90	0.83	0.93	0.70	0.89

*Notes: * t statistics are significant at a significance level of 0.05 (t ≥ /1.96/).*

***The observations for R&D cover the period 1978 to 1993 owing to lack of data.*

Appendix 1. Annual Data on GDP, Input and TFP Growth in Taiwan's Service Sector: 1962-96

Year	(1) GDP (at factor price)	(2) GDP Growth Rate	(3) Capital	(4) Capital Growth Rate	(5) Translog Capital Index	(6) Translog Capital Index Growth Rate
1962	75559.06	-	122012.8		0.026329	-
1963	89037.66	0.16414	137095.4	0.11655	0.030751	0.15526
1964	96656.53	0.08210	154436.5	0.11911	0.036542	0.17255
1965	111555.6	0.14336	174987.4	0.12493	0.043656	0.17788
1966	119171.6	0.06604	191541.6	0.09039	0.048296	0.10099
1967	135259.9	0.12663	214030.8	0.11101	0.055336	0.13608
1968	144788.7	0.06808	236455.5	0.09964	0.061791	0.11033
1969	151989.4	0.04854	258651.3	0.08972	0.067772	0.09239
1970	170129.1	0.11275	286094	0.10084	0.07639	0.11971
1971	198862.6	0.15606	320140	0.11244	0.087681	0.13786
1972	225395.7	0.12524	362199.9	0.12344	0.099128	0.12270
1973	264599.9	0.16036	410737.3	0.12576	0.112562	0.12710
1974	282777.6	0.06644	478565.7	0.15284	0.132793	0.16529
1975	287392.2	0.01619	542189.9	0.12482	0.148237	0.11002
1976	316705.7	0.09713	620298.1	0.13458	0.167718	0.12347
1977	350667.1	0.10186	645923	0.04048	0.182324	0.08350
1978	406533.1	0.14783	687453.6	0.06231	0.202784	0.10636
1979	458806.5	0.12096	727693.2	0.05689	0.222597	0.09322
1980	507531.2	0.10093	784105.4	0.07466	0.249184	0.11283
1981	551976.6	0.08395	840896.7	0.06993	0.274604	0.09714
1982	585646.4	0.05921	871025.7	0.03520	0.289307	0.05216
1983	619657.7	0.05645	903503.2	0.03661	0.303773	0.04879
1984	695715.8	0.11577	943548.4	0.04337	0.320961	0.05504
1985	752890.2	0.07898	976759.1	0.03459	0.334379	0.04096
1986	863554	0.13714	1009882	0.03335	0.347493	0.03847
1987	980569.4	0.12708	1106774	0.09162	0.381045	0.09217
1988	1118520	0.13163	1241117	0.11456	0.428702	0.11785
1989	1280615	0.13533	1398824	0.11962	0.483846	0.12100
1990	1412901	0.09830	1503720	0.07231	0.523464	0.07870
1991	1536200	0.08367	1653792	0.09513	0.571585	0.08795
1992	1677681	0.08810	1894453	0.13586	0.659071	0.14242
1993	1838282	0.09142	2114458	0.10987	0.739048	0.11453
1994	1942586	0.05519	2350422	0.10580	0.824826	0.10981
1995	2083940	0.07024	2593638	0.09847	0.913241	0.10183
1996	2249309	0.07636	2832301	0.08803	1	0.09076

Appendix 1 (Continued)

Year	(7) Labor	(8) Labor Growth Rate	(9) Translog Labor Index	(10) Translog Labor Index Growth Rate	(11) Share of Capital Compensation	(12) Share of Labor Compensation	(13) TFP Growth Rate
1962	1977131.9		0.171228	-	0.669967	0.330033	-
1963	1999663.3	0.01133	0.173174	0.01130	0.638431	0.361569	0.087409
1964	2010929.0	0.00562	0.174146	0.00560	0.607431	0.392569	0.007018
1965	2267223.9	0.11996	0.199078	0.13380	0.622913	0.377087	-0.008316
1966	2453108.1	0.07880	0.213876	0.07170	0.622375	0.377625	-0.017770
1967	2638992.3	0.07304	0.226263	0.05630	0.617598	0.382402	0.037623
1968	2881205.0	0.08781	0.248563	0.09400	0.572816	0.427184	-0.032164
1969	3050190.7	0.05700	0.270642	0.08510	0.60831	0.39169	-0.039308
1970	3224809.2	0.05567	0.278689	0.02930	0.631031	0.368969	0.046554
1971	3329017.0	0.03180	0.288471	0.03450	0.618793	0.381207	0.078919
1972	3574046.1	0.07102	0.308369	0.06670	0.58779	0.41221	0.036843
1973	3931732.4	0.09538	0.340187	0.09820	0.602536	0.397464	0.051175
1974	3988060.9	0.01422	0.342748	0.00750	0.595317	0.404683	-0.001329
1975	3988060.9	0.00000	0.345328	0.00750	0.584461	0.415539	-0.029082
1976	4134515.1	0.03606	0.359170	0.03930	0.599039	0.400961	0.026642
1977	4528814.9	0.09109	0.393309	0.09080	0.586651	0.413349	0.013776
1978	4720332.0	0.04142	0.409688	0.04080	0.596869	0.403131	0.082784
1979	5023952.4	0.06234	0.430478	0.04950	0.604934	0.395066	0.054848
1980	5306101.2	0.05464	0.458562	0.06320	0.609375	0.390625	0.018539
1981	5523984.0	0.04024	0.483038	0.05200	0.601732	0.398309	0.014535
1982	6003440.4	0.08323	0.496457	0.02740	0.589812	0.410224	0.022505
1983	6183523.2	0.02956	0.501998	0.01110	0.571364	0.428658	0.031810
1984	6247510.8	0.01029	0.523636	0.04220	0.570491	0.429538	0.069096
1985	6456453.6	0.03290	0.532560	0.01690	0.57414	0.425887	0.053661
1986	6769825.2	0.04740	0.547628	0.02790	0.561565	0.415001	0.105922
1987	7160025.6	0.05604	0.647421	0.16740	0.560153	0.407898	-0.010405
1988	7461024.0	0.04118	0.700711	0.07910	0.558004	0.396985	0.042629
1989	7709755.2	0.03279	0.754757	0.07430	0.567799	0.40747	0.047817
1990	7876591.2	0.02141	0.779456	0.03220	0.563383	0.408455	0.051051
1991	8169445.2	0.03651	0.796714	0.02190	0.563508	0.411013	0.039880
1992	8530374.0	0.04323	0.841677	0.05490	0.550565	0.417765	0.005592
1993	8912308.8	0.04380	0.891848	0.05790	0.556444	0.410077	0.016756
1994	9177859.2	0.02936	0.932179	0.04423	0.57111	0.42889	-0.010582
1995	9346443.6	0.01820	0.955387	0.02459	0.570893	0.429107	0.018815
1996	9670508.4	0.03408	1.000000	0.04564	0.570187	0.429813	0.015068

Note: Growth rate is calculated by taking the logarithm of growth rate between two years.

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INDONESIA

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CASE STUDY OF PRODUCTIVITY MEASUREMENT IN THE EDUCATIONAL SECTOR

PRODUCTIVITY TRENDS IN INDONESIA

National Productivity

Labor productivity growth in Indonesia has been decreasing since 1993. Two major factors influencing this are the rate of growth of Gross Domestic Product (GDP) and the growth of the labor force. Although the growth of the labor force is slowing down, GDP growth has declined at a faster rate. As a result of the economic crisis in 1997, GDP growth in Indonesia, expressed in nominal terms, decreased from 8.22 percent in 1995 to -0.09 percent in 1998 (Table 1). This was caused by the uncertainty of the economic situation and fluctuations in the exchange rate against the US dollar. At the same time, the quality of labor has been increasing due to improvements in educational levels and skills training. This translates into improvements in the capacity of the labor force to generate products and services.

Table 1. Indonesian Productivity Indicators

Year	GDP	GDP Growth	Labor Force	Growth in Labor Force	Productivity Level	Labor Productivity Growth
	(Rp Billions)	(%)		(%)		(%)
1992	307,474.1	-	78,616,097	-	3,911,083	-
1993	329,775.8	7.25	79,234,815	0.79	4,162,006	6.42
1994	354,640.3	7.54	80,066,276	1.05	4,429,341	6.42
1995	383,777.3	8.22	82,427,598	2.95	4,655,932	5.12
1996	414,419.0	7.98	85,045,458	3.18	4,872,912	4.66
1997[1]	433,685.2	4.65	87,046,595	2.35	4,982,219	2.24
1998[2]	433,310.3	(0.09)	88,942,036	2.18	4,871,828	(2.22)

Notes: 1. Preliminary figures 2. Very preliminary figures 3. Figures in brackets indicate negative values
Source: Central Bureau of Statistics, produced by Dit.Binaprotek

Productivity by Sector

Indonesia categorizes its economy into nine sectors, which are: Agriculture; Mining; Manufacturing; Electricity, Gas and Water; Construction; Trade, Hotels and Restaurants; Transportation and Communications; Financial Institutions and Building Leasing; and Services. In 1996, the financial institutions and building leasing sector achieved the highest productivity level, which was Rp 54,224,751.0 per worker. The lowest productivity level was registered by the agricultural sector. However, from 1993 to 1998, the agricultural sector had the highest labor productivity growth rate, averaging 5.69 percent, followed by the financial institutions and building leasing sector at 4.21 percent (Table 2).

Table 2. Labor Productivity Growth, 1993-1998 (base year 1993)

No.	Sector	Year						
		1993	1994	1995	1996	1997[1]	1998[2]	Average
1	Agriculture	6.94	10.11	8.41	(3.79)	5.89	6.56	5.69
2	Mining	(1.45)	(5.16)	20.69	(12.24)	(12.24)	(7.38)	(2.94)
3	Manufacturing	4.67	(7.87)	17.29	11.59	(4.07)	(11.89)	1.62
4	Electricity, Gas and Water	5.17	6.12	28.04	13.18	(21.29)	(11.62)	3.26
5	Building and Construction	2.45	(8.97)	5.48	12.76	(3.82)	(12.14)	(0.71)
6	Trade, Hotels and Restaurants	3.15	(0.48)	(9.34)	8.00	(1.39)	(7.02)	(1.18)
7	Transportation and Communications	(5.57)	(6.01)	(7.02)	8.68	3.32	(10.04)	(2.77)
8	Financial Institutions and Building Leasing	2.79	5.17	1.06	9.00	10.03	(2.79)	4.21
9	Services	(3.15)	2.13	(5.16)	3.40	(4.37)	(4.02)	(1.86)
National Productivity		6.42	6.42	5.12	4.66	2.24	(2.22)	3.77

Notes: 1. Preliminary figures 2. Very preliminary figures 3. Figures in brackets indicate negative values.
Source: Central Bureau of Statistics

Overall, the labor productivity growth rate for 1998 is expected to have declined by 2.22 percent compared to the 1997 figure as a result of the economic crisis (Table 1).

WHY MEASURE PRODUCTIVITY?

With the increase in living standards, people are demanding better services. In order to meet that demand, it is not only the effectiveness of service provision that needs to be improved but also the efficiency of the processes involved in providing services. It is, however, often not easy to achieve greater effectiveness and efficiency because of barriers such as a lack of clearly defined objectives, poor management, and lack of performance monitoring and productivity measurement.

Productivity measurement is important in improving performance because it can:

- Help establish the best strategy for resource utilization and cost effectiveness;
- Identify activities that should be changed and factors that need attention; and
- Reveal the financial implications of alternatives and track the correlation between the operational plan and budget.

PRODUCTIVITY MEASUREMENT METHODS

While the main factor that we want to determine is the degree of satisfaction of our customers, the effectiveness and efficiency of the services we provide are also important. This is because we not only have to satisfy customer needs but also be able to do so in much better ways. The measurement of effectiveness is related to the result and impact of service activities, while efficiency is measured as output divided by input.

For effective productivity measurement, there are several things that should be done. First, we have to know our objectives, and this entails having answers to the following questions:

- Who are the users of the service?
- What is the condition of the users before they use the service?
- What is the outcome of using the service?
- What kind of quality is expected?
- What resources are needed?
- How is the service provided?
- What factors influence the process?

Second, we need to define the parameters of the goals, and the output and input, not only for the main activities but also for all sub-activities. To judge how well we perform, we can use our past performance as a benchmark or find another similar organization that provides the same service for comparison.

SOME BARRIERS TO PRODUCTIVITY MEASUREMENT

There are a number of issues that have to be considered for effective productivity measurement in services. Firstly, the outputs of the service sector are intangible, so we need to be able to specify the product and/or service and what it is supposed to achieve (its goal), and quantify both. Furthermore, in non-service sectors such as manufacturing, the customer does not witness the process of making the output. However, in many service industries, the customer experiences every activity that makes up the process of delivering the service.

Secondly, not all the results of providing a service can be seen in the short term. For example, most public service programs have very long-term results, so improved effectiveness rather than efficiency would constitute a more important objective. Thirdly, there is usually no single measurement approach or system that can provide all the necessary information, especially for comparisons. The final issue concerns the nature of organizations that provide services. Sometimes comparisons are frustrated because different strategic assumptions underpin organizations that provide the same services. Thus if we wish to measure productivity levels, we also have to analyze the basic assumption or condition of the organization.

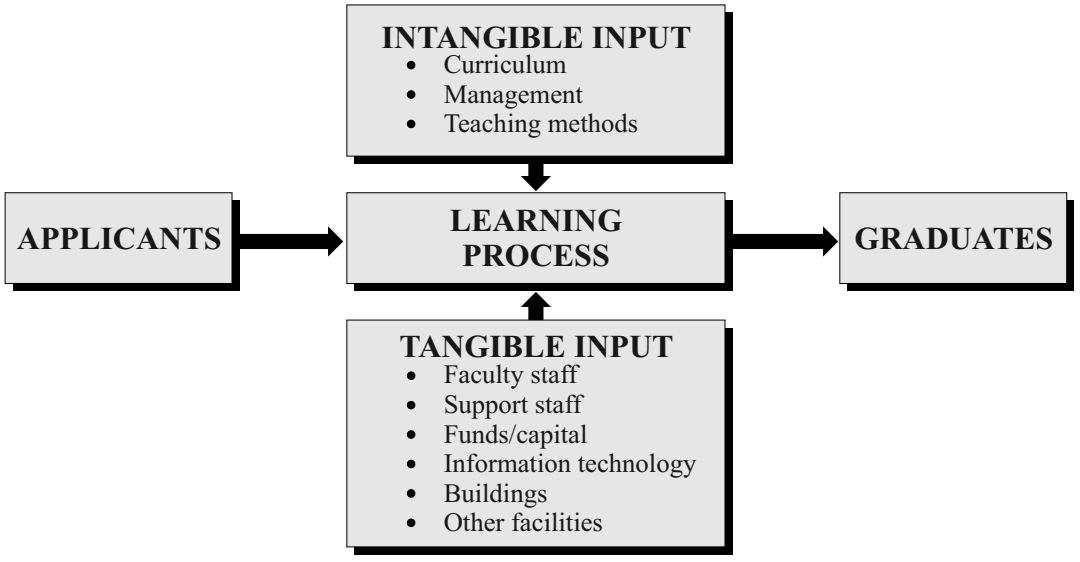
PRODUCTIVITY MEASUREMENT IN EDUCATIONAL INSTITUTIONS

The Educational System

The educational system is a set of interrelated parts aimed at improving the knowledge and skills of students and producing graduates with a certain level of capability. The system consists of three sub-systems: input, process, and output (see Figure 1). Applicants (input) enter the system. They are transformed through a series of educational programs (process), and they exit the system as graduates (output).

Like any value-adding system, the educational system needs to be managed. Such management should be concerned with the productivity of the system and therefore needs to be able to measure and improve productivity. As already mentioned, before measuring the performance of an educational institution we have to know the objectives of the system, what the outputs are, how the services are produced, and what the required resources are.

Figure 1. The Educational System



Objectives

The overall objective of the educational system is to promote the welfare of society by improving the quality of human resources. This is a long-term objective and its achievement cannot be judged in the short term, therefore we need to find other, short-term, measures that are indicative of longer-term results. In the case of a university, for example, such measurements could include the graduates' average academic grade performance, their average length of study, their waiting time for their first jobs, their first salary levels, etc.

Process

The purpose of an educational process is to help students understand certain subjects and to instill an ability to approach real world problems effectively and efficiently. This can involve a variety of approaches from classroom learning to group discussions or out-of-class activities such as company visits.

The students are the subjects and at the same time the customers of the educational process. One thing to consider is the quality of the students because it can influence the result. With the same process, a different quality of applicant can produce a different quality of graduate.

In addition to the main educational activities, there are also supporting activities that are undertaken by educational institutions. These would include the services offered by the staff of the administration unit, the library, and other institutional facilities. Such supporting activities help to create an enabling atmosphere for the students.

Output

The output of the educational system can be measured in two ways, quantitatively and qualitatively. In quantitative terms, the educational process may produce as many graduates as possible; qualitatively, however, it is beneficial only if it produces graduates of a quality that matches the needs of the community.

The outputs of the system are identified not only in terms of its main core activities but also in terms of its supporting activities - for example, the length of time taken to complete administrative activities, student satisfaction with the library services provided and whether the books in the library meet their needs - and so on.

Input

There are two major aspects to the input of the educational process. The first is the intangible input such as the curriculum, the management of the institution, and teaching methods. The second is the tangible input, which would include faculty staff, support staff, grants from government, buildings, information technology, multi-media equipment, the library and other facilities. Not all input can be readily quantified - tangible input is, of course, easier to quantify than intangible input - and consequently we may have to use qualitative indicators.

Productivity Measurement Methods

Basic Approach

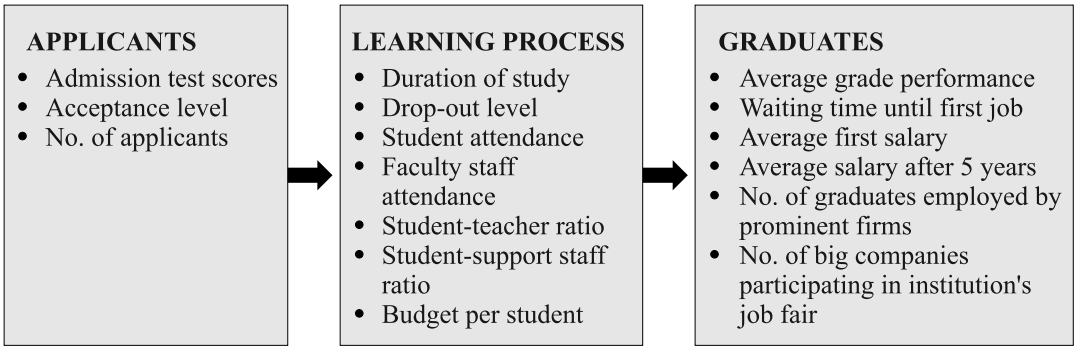
The most common way to measure productivity in an educational institution is to compare the output of the educational system to the input. Some examples of this type of measure are:

- Number of graduates per year;
- Number of students per instructor;
- Ratio of applicants to the number of graduates; and
- Budget spent per graduate.

Contemporary Approach

Measurement based merely on input and output figures may not be sufficient to portray the results of the educational system. Such figures cannot be used to identify which parts of the system need to be improved if we want to improve overall performance. Thus, for every sub-process or part of the main or supporting activities, we have to develop performance indicators (see Figure 2).

Figure 2. Examples of Performance Indicators



This modern approach to productivity tends to relate productivity measures to the customer satisfaction objective. For example, one university may successfully produce a superb physicist. However, if the physicist then has difficulty in finding a job, the university's effort has not been productive, since it does not produce graduates that meet the needs of business.

Today, productivity measurement results are often benchmarked against the productivity of the most outstanding comparable educational institution. With such an approach, it is easy to understand how productivity measures can be used to enhance competition among educational institutions.

Overall Productivity Measures

Regardless of their limitations, overall productivity measures that cover the entire educational system are important. At the very least such figures give us a first and fast indication of the performance of the system as a whole. In addition, they can be easily compared to the productivity figures widely available. Also, overall figures may signal the need for a deeper investigation into parts of the educational system.

SUMMARY

1. Productivity measurement is very important for productivity improvement.
2. Productivity measurement in the service sector is slightly different from that in the non-service sector because of differences in how the output is processed. Many of the outputs and inputs of the service sector cannot be quantified easily because some of them are intangible.
3. To have a better picture of the productivity of a system, we must measure not only the main activities but also the sub-activities and relevant supporting activities.

PAKISTAN

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INTRODUCTION

We have entered an era where the traditional pillars of economic power - capital, land, plant and labor - are no longer the main determinants of success. Instead, success depends on knowledge competencies like technological know-how; problem-solving expertise; personal creativity; the ability to innovate, develop and complete projects with improved speed, agility and safety; seeking new business opportunities and new ways of doing business; exploiting new technologies; and faster and better decision-making processes. Competitive advantage comes from creating knowledge from data, sharing best practices, applying the best decision-making expertise, and sourcing expertise efficiently. It depends on exploiting existing commercial know-how, learning about new technologies and the needs of consumers, disseminating the right knowledge at the right time and the right place, and sharing knowledge through co-operative problem-solving. Effective performance management promotes new ideas, captures and shares experiences and combines different areas of expertise as and when required to provide efficient customer service.

Economic growth is driven by the creation of better and better recipes to combine our available resources in more and more efficient and innovative ways. That is why the generation, application and exploitation of knowledge is the driving force of modern economic growth. In all industries, the key to competitiveness increasingly turns on how people combine, marshal and commercialize their know-how.

There is no longer a need to make a distinction between the service and manufacturing sectors when establishing performance parameters. This is due to the fact that the knowledge component of all outputs, whether products or services, is increasing day by day and reducing their physical resource or 'hard' content. Moreover, the goods and services we consume have become much more technologically sophisticated and knowledge intensive. In the same way that the price fell with higher product volumes reaching the market, now it falls with increased knowledge content. So for both technological and competitive reasons, knowledge is becoming the critical distinctive factor of production in the new economy. This is the reason that Thomas A. Stewart in his *Fortune* magazine article (November 1998) classifies products into two categories. The first is 'knowledgized products' such as cars, whose major component is knowledge and know-how, and the second is 'productized knowledge', meaning that the knowledge itself is sold as a product.

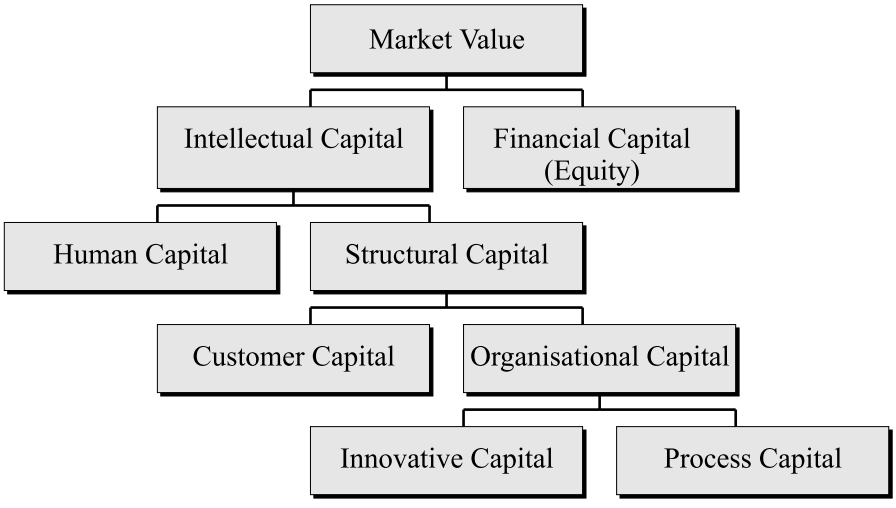
In contrast to most work in the past, which was simple and routine, most work is now tied to knowledge and the ability of employees to transform it into profitable action. Depending on the capabilities of the individuals concerned, the same quantity of labor may now achieve completely different business results, in contrast to earlier times when a given amount of routine work produced more or less the same quantities of a product. This change has given an entirely different perspective to the concept of labor and, for that matter, service sector productivity. The challenge is therefore to establish a different evaluation system for measuring and managing business success, with the emphasis shifting from cost control to value adding.

All high-performance organizations, whether public or private, are - and must be - interested in developing and deploying effective performance measurement and management systems, since it is only through such systems that they can remain high-performance organizations. The productivity of the new intangible assets cannot be measured with outmoded industrial age tools and techniques. The shift has given rise to the need to develop softer parameters to measure quality of service, customer retention and satisfaction, and employee loyalty. New performance metrics must take into account the changing definition of success (customer experience, not just the price and product differentiation).

This new 'service paradigm' is shaking the foundations of all industries without exception. It is diverting economies from the traditional factors of production to building a lasting foundation for business success on the innovative capabilities of employees and other intangible assets. This moves the focus of attention from managing tangible resources to measuring and managing the productivity of intangible resources, which is the main focus of this paper.

Before delving into productivity issues, we need to identify the intangible resources that are developed and marshaled by organizations in seeking to build competitive advantage. Karl Sveiby (1997) has classified these intangible (or intellectual) assets initially into the two areas of human and structural capital (see Figure 1). Structural capital is then further broken down into customer capital and organisational capital. The tools of the industrial age have failed to account for and manage them. Evolving practices for managing the productivity of such resources are discussed in the paragraphs that follow.

Figure 1. Intangible Assets



PREREQUISITES OF PRODUCTIVITY MEASUREMENT

Leadership

Leadership is critical in designing and deploying effective performance measurement and management systems. Clear, consistent, and visible involvement by senior executives and managers is a necessary part of successful performance measurement and management systems, and senior executives should be actively involved in both their creation and implementation.

Conceptual Framework

A conceptual framework is needed for any performance measurement and management system so that it is understood by all levels of employees and supports objectives and the collection of results.

Communication

Effective internal and external communications are the key to successful performance measurement. Effective communication with employees, process owners, customers, and stakeholders is vital to the successful development and deployment of performance measurement and management systems. Both organizational outsiders and insiders need to be part of their development and deployment.

Accountability

Accountability for results must be clearly assigned and well understood. High-performance organizations clearly identify what it takes to determine success by making sure that all managers and employees understand their roles in achieving organizational goals. Accountability is typically a key success factor, as will be seen later in this paper, but one with multiple dimensions and applications.

Productivity Evaluation

Productivity measurement systems must provide intelligence for decision-makers, not just compile data. Performance measures should be limited to those that relate to strategic organizational goals and objectives, and that provide timely, relevant, and concise information for use by decision-makers at all levels to assess progress toward achieving predetermined goals. These measures should provide information on the efficiency with which resources are transformed into goods and services and on the effectiveness of activities and operations in terms of their specific contributions to organizational objectives. Managers should choose productivity measures that help them describe organizational performance, direction, and accomplishments, and then aggressively use these to improve products and services for customers and other stakeholders.

Compensation System

Compensation, rewards, and recognition should be linked to productivity measures. Performance evaluations and rewards need to be linked to specific measures of success, and financial and non-financial incentives tied directly to performance. Such linkages send a clear and unambiguous message to the organization as to what is important.

Supportive Culture

Performance measurement systems should be positive, not punitive. The most successful performance measurement systems are not 'gotcha' systems, but learning systems that help the organization identify what works and what does not so as to improve on what is working and repair or replace what is not working. Productivity measurement is a tool that allows the organization to track progress and direction toward strategic goals and objectives.

Open Book Management

Results and progress toward commitments and objectives should be openly shared with employees, customers, and other stakeholders. While sensitive financial and market information generally must be protected, performance measurement system information should be openly and widely shared with employees, customers, vendors, and suppliers. Many reputable organizations maintain information on their performance objectives and progress toward these on their Internet and Intranet sites for real-time access by various levels of management, teams, and sometimes individuals. Most use periodic reports, newsletters, electronic broadcasts, or other visual media to set out their objectives and accomplishments. This is called 'open book management', and it is gaining worldwide popularity due to its substantial positive impact.

Applicability

Before productivity measurement metrics are developed, the following factors should be considered and evaluated to assess their impact on the organization's ability to develop and apply performance indicators:

- The time and cost associated with developing indicators;
- The use and interpretation of indicators;
- Communicating the value of indicators both internally and externally; and
- Comparability, both internally and externally.

KEY SUCCESS FACTORS FOR PRODUCTIVITY MEASUREMENT

World-class organizations use performance measurement systems to determine whether they are fulfilling their vision and meeting their customer-focused strategic goals. In doing so, their performance measures strive to meet the following criteria:

- *Ensure a narrow, strategic focus.* The measures and goals an organization sets should be limited to a critical few. It is neither possible nor desirable to measure everything. In addition, mature performance measurement systems are linked to strategic and operational planning. World-class organizations know where they are headed through effective customer-driven strategic planning. They know how they are progressing by measuring performance against corporate goals and objectives. Organizational strategy provides a framework within which business units, teams, and individuals can implement a performance measurement system, freeing organizations from 'rescue initiatives' in areas that produce little value and, equally importantly, avoiding data overload.
- *Measure the right thing.* Before deciding on specific measures, an organization should identify and thoroughly understand the processes to be measured. Then, each key process should be mapped, taken apart and analyzed to ensure a thorough, rather than assumed, understanding of the process. A measure central to the success of the process is then chosen. In some cases, targets and minimum and maximum performance levels are defined for each measure (see also *Determining a Baseline & Goals*).
- *Be a means, not an end.* In best-in-class organizations, employees and managers understand and work toward the desired outcomes that are at the core of their organization's vision. They focus on achieving organizational goals by using performance measures to gauge goal achievement, but do not focus on the measures per se. Performance measurement is thus seen as a means, not an end. So focus on the goal, measure the end results, and do not focus purely on the measurement.

Determining a Baseline & Goals

When an organization has decided on its performance measures, the next step in the process is to determine a baseline for each of the measures selected. Once data are collected for the first time on a particular performance measure, the organization then has baseline data. Determining appropriate goals for each measure after these baseline data are collected can be accomplished in several ways. The organization may use various statistical analysis techniques as well as benchmarking to set goals for future performance.

A common practice is to set goals that will force the organization to 'stretch' to exceed its past performance. Through benchmarking it can test the validity of its goals. For example, a goal of 100 percent customer satisfaction may be an admirable goal for any organization. However, if industry standards have been at 80 percent, a goal of 100 percent may not be realistically attainable. Setting a 100 percent goal anyway can easily demotivate employees by giving them an essentially impossible target. Setting a quality standard with zero tolerance for human error undermines morale and makes goals appear unattainable. Organizations should instead set goals that excite an employee's interest and elicit commitment. To this end, it is important to provide information on productivity goals and results to employees. Information on key goals and measures can be made accessible to all employees through media such as Intranets, newsletters, and bulletin board displays. This increases employee understanding of the organization's mission and goals and unifies the workforce behind them. It also helps to emphasize a team philosophy rather than foster individual competition.

Reviewing Measures

An important aspect of productivity measurement is its iterative quality. Organizations should continually assess whether their current measures are sufficient or excessive, are proving to be useful in managing the business, and are driving the organization to the right result. This review enables the organization to make sure that it is maintaining the right measures. When measures become obsolete, they should be discarded, and possibly replaced with something else. Measures should be dropped if they prove not to be a fair reflection of changes taking place - when, for instance, no change in the measurement results has occurred even after extensive interventions in the process being measured.

Productivity analysis also lets organizations change the priority of specific measures over time. Some productivity goals, for instance, are intended to influence behavior and should be de-emphasized once target productivity is achieved. Some other goals may change due to the nature of the business, market conditions, or regulatory requirements. Some organizations regularly develop employee change teams to look at the measures and determine whether they might need adjusting. Refining and changing measures is healthy and necessary, but too frequent changes will cause confusion and may affect accountability.

Continuous and regular review of measures as they relate to the corresponding goals and the organization's strategic plan is the key to success in productivity measurement. It not only helps in deciding the right things to measure, but provides needed information to assess progress toward reaching goals at all levels within the organization. Productivity measurement has no purpose if data are not used to improve organizational productivity.

METHODOLOGIES FOR SELECTION, USE AND PRESENTATION OF PRODUCTIVITY PARAMETERS

"What gets measured gets done."

Objective Setting

As Michael Porter rightly says, "It's not just a matter of being better at what you do - it's a matter of being different at what you do". A good strategy is concerned with structural evolution of the industry as well as with the organization's own unique position within that industry. Strategy is the activity of aligning an organization's resources with opportunities in its environment in a way that allows it to achieve its defined objectives.

Performance measurement represents a review of specific facets of performance with regard to organizational objectives. The measurement base may be financial or non-financial. A relevant performance measure focuses on some objective, or on some activity that is thought to influence the achievement of an objective. The primary roles of performance measurement are:

- To direct employees' attention to the organization's objectives and to the processes that pursue those objectives;
- To support the process of organizational improvement by identifying cause and effect relationships between measures of process performance (such as product quality and customer service) and measures of performance on primary objectives (such as profits); and
- Where required, or deemed desirable, to provide a basis for accountability between a superior and a subordinate.

There are five major stakeholder groups that potentially impact on the organization as it pursues its objectives: customers, employees, owners or principals, value chain partners, and the general community. Each of these groups is potentially a stakeholder of the organization in the sense that it can affect the organization's ability to achieve its stated objectives. The importance of a given stakeholder group will vary from critical to irrelevant within different organizations.

The primary vehicle for any organization to achieve its objectives is meeting the needs or expectations of its customers. Therefore, strategy should focus on defining the organization's value proposition, which is a statement of how it plans to meet customer requirements in a way that exceeds the potential or capabilities of competitors. Organizations enlist, to varying degrees, the help of other stakeholder groups to meet customer requirements. Employees and value chain partners design and operate the value chain that provides the organization's customers with goods or services, while the community defines the general guidelines, including laws and social expectations, that constrain the design of the value chain.

Productivity measurement focuses on the measures needed to design and manage a process that meets customer requirements in a way that allows the organization to meet owner-specified objectives. The defining feature of performance measurement is that each performance element that it identifies and measures is one that is related to achieving the organization's strategy. Therefore, the measurement system is separate and distinct from the operations systems used to effect short-run control by measuring the day-to-day performance of operations. The organization's primary objective or set of objectives, as stated by the organization's owners, should be clear and measurable. In circumstances where there are multiple objectives that can conflict, the statement of objectives should indicate how each objective is to be weighted when decisions are made.

The productivity measurement system should be complete in that it captures all the drivers of performance towards the primary objective. These drivers, or secondary objectives, are the focus of management decision-making and constitute major elements of any performance measurement system. When corporate-level performance measures are driven down the organizational hierarchy to create a set of productivity measures for an individual, it is important that the set of performance measures chosen reflects the range of the individual's responsibilities, not a single facet of performance. On the other hand, the individual should not be overwhelmed with a set of performance measures that are unmanageable.

An organization is an entity that is a creation of its owners (in the case of profit-seeking organizations) or its principals (in the case of not-for-profit organizations). In the performance measurement process the primary role of owners is to define, or validate, the organization's objectives. For example, in profit-seeking organizations, the owners validate organizational objectives by retaining or firing senior executives, or by investing or disinvesting in the organization. In a parliamentary democracy, the Cabinet plays the same role by accepting or changing the departmental objectives proposed by senior public servants.

The organization's primary objective is the objective chosen for it by its owners. In profit-seeking organizations, the primary objective is profit-related and is expressed in terms of a profitability measure such as return on investment or earnings per share. In not-for-profit organizations, the primary objective reflects the purpose of the organization and is usually stated in terms of meeting some social objective. For example, a police department defines its objective as reducing crime. The specification of a clear and measurable primary objective is a necessary condition for the development of strategy, and forms the foundation and focus for the process of performance measurement.

Most organizations have a single primary objective, such as profitability for a profit-seeking organization. However, some organizations have multiple primary objectives. Multiple primary objectives exist when one objective can only be increased at the expense of another. For example, a profit-seeking organization may have a stated social objective that at least 50 percent of its raw material must be purchased in the local community. When this objective is stated with the full understanding that its ultimate effect will be to downgrade performance on profits, the owners have created an organization with multiple primary objectives. In this situation it is critical that they specify the rule that will be used to balance the two objectives. In the example provided, the rule given is that the local acquisition of raw materials must be 50 percent regardless of cost. Note that the distinguishing characteristic of an organization with multiple primary objectives is that the primary objectives conflict.

Strategy Building

Once the organization has clearly stated its primary objective, it can develop the business-level strategy and functional-level strategies it will use to pursue that objective. There are three levels of organizational strategy:

- The *organization- or corporate-level strategy* defines the organization's business or primary purpose;
- The *business-level strategy* defines the organization's target customers or clients; and
- The *functional-level strategy* defines the tools, processes, and systems that the organization will use to pursue its business-level strategy.

The business-level strategy defines the general approach the organization will use to compete for customers or, more generally, meet customer requirements. For example, approaches for profit-seeking organizations may be becoming the low-cost producer or the niche competitor that meets the specialized needs of a target group of customers, or continuous innovation. The functional-level strategy defines the processes the organization will design and implement to pursue its business-level strategy. Examples are just-in-time manufacturing and incentive compensation systems for employees.

The specific business- and functional-level strategies chosen reflect the organization's belief about the relationship between what it does and performance against the primary objectives. That is, the business- and functional-level strategies reflect the organization's belief about what drives performance towards the primary objective.

The next step in developing a performance measurement system is to identify performance measures for the processes the organization develops and implements to pursue its strategy. These performance measures focus on how each process contributes to the organization's primary objective, and allow decision-makers to monitor the processes the organization uses to pursue that objective. Therefore, the chosen objectives and strategies define the scope and focus of the performance measurement system.

Establishing Accountability for Productivity

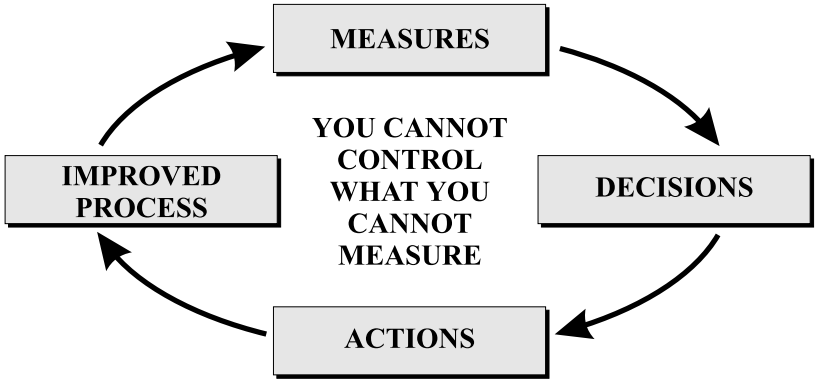
Establishing viable productivity measures is critical for organizations; making those measures work is even more important. Once the productivity measurement system is created, the next step is to implement it within the organization. The key issue with productivity measurement is deployment - success is 20 percent approach, 80 percent deployment. Successful deployment strategies that establish employee and management accountability for the success of the organization's productivity measurement system are discussed in the following sections.

Empowerment

Employees are most likely to meet or exceed productivity goals when they are empowered with the authority to make decisions and solve problems related to the results for which they are accountable. In many ways, accountability is analogous to a contract between manager and employee, with the manager providing a supportive environment and the employee providing results. Experience of best-in-class organizations suggests that setting more than seven performance measures for an individual is unwieldy and five is the largest number that is comfortable for most individuals to manage.

The productivity goals of an organization represent a shared responsibility among all its employees, each of whom has a stake in its success. A critical challenge for private and public organizations alike is ensuring that this shared responsibility is fulfilled. Accountability helps organizations meet this challenge. As depicted in Figure 2, the improvement process is a closed loop. Responsibility is attached to authority resulting in accountability. The key criterion for accountability is that employees can only be held accountable if they have control. However, it is believed that measures over which organizations have no control - external measures - should also be included.

Figure 2. The Measurement Loop



Underlying employee empowerment is management's view of its employees as an asset rather than a resource. The term 'asset' implies that employees are to be valued and cared for, while a 'resource' is something that is used up and replaced. In many leading organizations, the process of productivity measurement has led to a better understanding of how individual employees or teams of employees contribute to the productivity goals of an organization. The contributions of individuals and teams are a starting point for enumerating the results for which they are accountable.

Owner Identification

Most managers from best-in-class organizations hold an appropriate individual accountable for each productivity measure and therefore identify a measurement owner. This is an assigned individual who is accountable for a particular measure. It is better to formally document who is accountable for each productivity target within a business unit. A single matrix identifies the business unit's goals and measures, the accountable individuals, and those individuals and groups that have a collateral responsibility for meeting the productivity target. A matrix may be used to identify and document roles that must be played to achieve organizational productivity targets. This matrix allows the business unit to emphasize business goals rather than internal process outputs.

Rewards & Incentives

It is important to stress that companies must have the 'right' system of rewards in order to attract and retain talented people. A well-designed compensation system should address key competencies, define metrics, motivate individuals, recognize the value of teamwork, and satisfy the organization as a whole. There is concern that compensation programs cater to everyone as opposed to concentrating on the 'key' employees that create competitive advantage for the organization. It is better to link pay or rewards to productivity measurement systems. Alternatively, managers must ensure that productivity goals are met by rating individual contributions to these goals in individual appraisals. One may also link corporate values with productivity measures for determining management compensation.

Incentives do not always have to be financial. For example, an organization might offer 'corporate money' provided by the local business community (consisting of coupons for restaurants and other local amenities) for immediate recognition of excellent productivity. Other rewards for exceptional productivity could include acknowledgement in newsletters and other publications as well as annual awards.

Culture & Communication

Corporate culture is a barrier when it is not used to manage performance. A positive culture encourages creativity and innovation through learning and sharing, values teamwork, fosters trust, and encourages risk-taking without fear of job loss. While flatter organizations are seen to be a positive change, a downside to this is observed. Flatter organizations make it more difficult for employees to see a career progression. There is a widely held view that teamwork at the lower levels in an organization leads to new ideas and better decision-making. Perhaps this suggests the need for more teamwork at the senior levels of management. There is a dire need for organizations to move to a more objective and formalized approach to managing their intangible assets in addition to the need to set short- and long-term achievable goals.

Failure to meet productivity goals must result in a comprehensive review of problems and possible solutions. The culture should embrace an understanding of the reality of human error and an endeavor to improve under conditions where employees do not fear admitting mistakes. Periodic meetings should be held to allow staff to review progress and strategize about solving problems. In essence, the focus has to be on corrective action, not blame. There should be established policies that institutionalize problem-solving approaches to deal with failure and substandard productivity.

Organizations should have formal written plans describing how productivity measures will be implemented. These plans should elaborate on the details of measures, goals, objectives, and their alignment to the organizational strategy. And, as mentioned earlier, it is essential to identify one individual who will be accountable for each measure.

GATHERING AND ANALYSING PRODUCTIVITY DATA

Data are collected and then analyzed for each productivity measure to determine if and how well goals are being met. It is very easy for the data collection and analysis phase of productivity measurement to get out of hand. Advanced technology facilitates this tendency since it is tempting to take advantage of the myriad data resources available via the Internet and Intranet. However, best-in-class organizations know that data collection and analysis are not research activities conducted for their own sake. Rather, data are collected and analyzed to get answers.

Organizations should collect data at all levels through any number of mechanisms, at both regular intervals and on an ongoing basis. Through it all, they should remain focused on the questions they are trying to answer. This focus on strategic alignment makes data collection a dynamic and vital, rather than tedious and never-ending, exercise. To achieve targeted objectives, the following data-gathering principles must be kept in mind:

Keep It Focused

Organizations should not be data rich and insight poor. Keeping data gathering focused is very much a senior leadership responsibility. This focus ensures that the right data and only the right data are collected, that repetitious or tangential compilations are avoided, and that the questions originally posed by the productivity measures are being answered.

Keep It Flexible

In best-in-class organizations, data are collected from a variety of sources and through a variety of media. Any one approach is not necessarily right or wrong. Although using automation is preferable, even world-class organizations use manual systems when needed and cost efficient.

Keep It Meaningful

Useful and relevant data can be gathered if the correct measures were set up in the first place. A few basic, well-aligned measures taken seriously are better than a number of complex measures. This is because, with simple measures, it is clear what data need to be collected; with well-aligned measures, it is easy to see the data's relevance. On the other hand, it is possible to carry simplicity too far. A recurring challenge to effective productivity measurement is to overcome a "long-lived work culture of transactional auditing that causes a focus on checklist-type, as opposed to results-oriented, trending". In other words, data collection must be tailored and thoughtful, not derived from a 'one-size-fits-all' master checklist.

Keep It Consistent

Data collection should be based on a set of agreed-upon definitions. These definitions need to be universally understood by employees, managers, partners, suppliers, and even customers. Data collected within a common framework of understanding can be easily compared and analyzed, allowing subsequent evaluations to be 'apples to apples'.

Each business unit and hierarchical level of an organization will have different needs for the data gathered. These differences should be reflected in the collection process. Data gathering responsibilities normally take the following forms:

- *Line supervisors and employees.* The data focus for line supervisors and employees relates to daily operations and customer service as these, in turn, are aligned with the organization's vision and strategic planning. Thus, line supervisors and employees collect operational productivity data. These data are often best gathered as part of the employees' interface with the customer.

- *Business unit managers.* Business unit managers need data that can be used to measure customer satisfaction, dissatisfaction, or indifference. These data are usually collected via customer surveys administered by a third party or in-house office. Another kind of data in which the business unit manager is interested involves program costs. These data come from the organization's accounting and cost accounting systems, which record expenses and revenues. Armed with these data, a manager can not only react to, but also institute, proactive measures to reduce unnecessary costs. Best-in-class business units also measure the health of their organizations. They survey employee morale and, where appropriate, employee safety. They look for skill deficiencies and try to be continuous learning organizations.
- *Executive management*. Senior managers need to determine whether their organizations are meeting or exceeding the expectations defined in their customer-focused strategic plans. Generally, they target a vital few measures as critical to their responsibilities. Rather than immersing themselves in day-to-day details, executives look for trends.

REPORTING PRODUCTIVITY INFORMATION

High-performing organizations do not measure things just for the sake of measurement. Rather, they report, evaluate, and use productivity information as an integral part of their productivity measurement systems. The aim is to inform various levels of management and employees about productivity, determine whether corrective action is necessary, and decide whether changes are necessary in the productivity measurement system, to the measures themselves, or to the organization's goals. Such organizations see productivity data as empirical information about the operation of their organizations and their customer or stakeholder requirements and preferences. Whether applied over the longer term or for short-term corrective actions, productivity information is reported, evaluated, and used as an underpinning for the continuous improvement of overall management and strategic planning processes. The following steps should be applied in the utilization of productivity information:

Report Information

Productivity information should be disseminated quickly. Putting useful information into the hands of an organization's decision-makers promptly and efficiently is critical. Many communication devices can be used to meet this objective, including meetings, reports and newsletters, charts placed in work areas, e-mail, publications, and video-conferencing. Intranets are also being used to give entire organizations access to productivity data summaries; this gives them the opportunity to be proactive about issues or adverse trends. Another productivity reporting objective is to keep employees at all levels 'in the loop', interested, and motivated. To this end, many organizations use sophisticated communication systems so that all staff receive productivity measurement status reports repeatedly in many forms.

In many organizations, scorecards are posted in all work areas, enabling everyone to know how they personally contributed to corporate productivity. Employee newsletters and regular daily feedback are other useful communication techniques. Some organizations use a weekly newsletter that contains updated information about the different branches, new employees, operating results, the business economy, and training schedule. Once each quarter, a more elaborate newsletter containing more detailed articles may be sent to each employee's home.

In some organizations, employees and executive staff share information with one another through a unique 'recognition days' program. Once each year, executive staff members, together with workers from various company sites, visit each branch of the organization to find out how things have been going. Other organizations use a system of icons representing each of the key productivity measures used within the business unit. These icons are posted widely throughout the workplace to focus employees' attention on the measures. This clever and effective deployment strategy serves to educate employees about the measures themselves as well as the status of their unit's productivity.

Evaluate Productivity

Organizational productivity evaluations are conducted periodically to best meet an organization's individual management information needs; they are typically scheduled on a monthly or quarterly basis. Depending on the types of activities and the organization, the frequency of evaluation could range from daily or weekly to semi-annually. In many cases, organizations use a combination of reviews at various intervals. For example, one organization uses a combination of a monthly office review, a six-month review, and an annual review. Others rely on quarterly senior management reviews.

In some organizations, reviews are done monthly to assess budget results and key project milestones, quarterly for customer satisfaction results, and annually for individual productivity. Many organizations undergo specific, externally mandated, six-monthly evaluations as part of their participation in ISO 2000. In addition, unscheduled events such as customer feedback, industry mergers, or changes in contracts, technology, or the market can all trigger a productivity evaluation.

While evaluation is done at various levels of the organization, the results usually flow up to a senior-level person, chief executive, or some type of senior executive committee for review. Senior management then determines whether corrective actions or changes are necessary in the productivity measurement system, the measures themselves, or the organization's goals.

There are many management tools and techniques available for conducting this type of top-level review and evaluation of productivity information. One useful approach is known as 'storyboarding'. This approach is based on a managing for results and management by fact 'storyboard'. The storyboard compares annual objectives and plan targets with year-to-date productivity and identifies any gaps. Staff members, generally those involved in either planning or quality who report directly to senior management, conduct either a 'gap analysis' or 'root cause analysis'. They develop recommendations to senior management as countermeasures or solutions. They also make recommendations as to who should be accountable for, the current status of, and the milestones related to, the countermeasures. Some organizations have developed a new aspect to the storyboard process - a countermeasure outlook. This includes an assessment of whether the countermeasure was capable of closing the identified gap, whether the proper resources had been allocated, and a prediction for productivity improvement.

USING PRODUCTIVITY INFORMATION/PERFORMANCE METRICS

Productivity information may be put to a number of uses, as discussed below.

Resource Allocation Decisions

There are important linkages between resource allocation, strategic planning, and productivity measurement. A high-performing organization's strategic planning process is directly related to and may drive the process of allocating its resources in pursuit of its goals and objectives. Its strategic plan is also directly related to what it decides to measure in terms of productivity and outcomes. However, the relationship between productivity measurement and resource allocation is less clear.

Productivity information should be factored into resource allocation decisions involving personnel or budgets. However, generally organizations should not rely solely on such information. Resource allocation decisions are likely to be based on tactical and/or strategic considerations related to new initiatives, specific markets, technologies, or other factors.

Employee/Management Evaluations

Most successful organizations have recognition or rewards systems linked to their productivity measures in some way. These organizations provide financial and non-financial incentives for productivity improvement. Many organizations hold managers accountable, factoring productivity measurement results into their bonus plans.

People should also be empowered and rewarded for making process changes based on productivity results. One company provides people with incentives for achieving productivity results based on doing things in a certain way. Quality success stories are shared two or three times a year. The chairman and senior officers review individual and team applications for significant improvement above and beyond the call of normal duty. A percentage of the savings is then shared with award recipients.

Other organizations use a multi-source feedback appraisal process for managers that provides for evaluation by their superiors, their employees, and their peers. In the case of one organization, this approach is used to assess organizational vision, team participation, integrity and dignity, job knowledge and skills, and continuous improvement. Other organizations combine a similar feedback appraisal process with an approach that evaluates not only productivity but also individual behavior (or values). The values used include respect for each other, integrity, trust, credibility, continuous improvement and personal renewal. These multi-source feedback reviews are often administered by an outside, third-party organization.

Determining Gaps between Goals & Reality

Productivity results can be used, as discussed above, to determine gaps between specific strategic objectives and/or annual goals and actual achievement. The root causes of these gaps are analyzed, and countermeasures developed and implemented. Whenever there is a gap between current results and an organization's objectives, it presents an opportunity for process improvement.

Driving Re-engineering

Many organizations implement re-engineering in response to the identification of gaps between objectives and achievement. Some of the areas re-engineered included cycle time, the organizational structure, outsourcing, information technology, and benefits programs. A good example of how productivity measurement may drive re-engineering is the case of one company that focused on addressing customer complaints. This organization achieved significant improvements over a twelve-and-a-half-month period by focusing on measuring the number of complaints that were addressed the same day if received by 3 p.m. This drove efforts to improve the process and to add technicians and resources.

Benchmarking

Organizations also use benchmarking as a methodology for organizational improvement, developing their productivity measurement systems, validating their operational positions, and maintaining world-class productivity. Many organizations primarily use external and competitive benchmarking, where they compare their operations with organizations outside. Some use internal benchmarking, where an internal business unit compares itself with similar business units within the same organization. Using the same productivity measures across business units facilitates internal benchmarking.

Most world-class organizations regularly participate in benchmarking consortia where participants from various industries meet to benchmark processes. These benchmarking consortia regularly use productivity measures to identify best practice.

Improving Organizational Processes

Managers are most often the ones empowered to make process changes. Some organizations use a multivariable testing technique to discover how process improvements can be made. Management sets up trial and control processes in such a way that employees can try various process improvements in a controlled manner and selectively identify changes that will improve process productivity. One company created a rollout group to escape from the 'fences' of individual teams and departments. This group, positioned to try new processes and to address process issues, meets every two months and is empowered to decide on how situations are to be handled. As a result of its efforts, cycle time for a particular product was reduced from 52 to 29 days and an employee survey was administered that identified the need for a better training program. Also, lack of sales growth has resulted in a major reorganization, including the development and implementation of a team structure.

Evaluating and Readjusting Goals

Goals should be challenging, requiring constant improvement, and if they are not met, companies should take corrective action. Conversely, if goals are exceeded, the bar should be reset to establish stretch goals.

Improving Measures

Organizations should display productivity measurements on bar charts and use raw data as a regular feature. As a next step, data should be validated and normalized. In the following years, bar charts may include the normalized data with a trend line and (say) a simple five-year moving average. Over longer periods, a logarithmic trend line may be used to obtain a better fit.

It is essential to understand that variation occurs in many selected measures, and that there are both normal and special causes for this. Organizations need to develop upper and lower statistical control limits around a productivity target and then management needs to analyze movements before acting. If actual productivity falls within the limits, no action should normally be taken.

Other Uses

Productivity indicators can also be used to manage human resources, improve operational efficiency, gain the competitive edge, facilitate budget planning, increase shareholder value, improve the quality of products, secure capital funding, market products and influence government policies.

APPROACHES TO PRODUCTIVITY MEASUREMENT

"You cannot create the future using the old tools" – Gary Hamel

Two broad approaches to productivity measurement are evident in practice. Each approach uses a different perspective to achieve the goal of linking productivity measurement with organizational strategy and the organization's primary objective. The first approach is the *process view*, which focuses on the value chain that the organization develops to meet the requirements of its target customers and, ultimately, to achieve its primary objective. The second approach is the *stakeholder view*, which focuses on the relationships that must be developed with the organization's stakeholders in order for it to achieve its primary objective. Both approaches strive to identify the critical measures that the organization must monitor to evaluate and continuously revise strategy in order to achieve its primary objective.

The Process View

The process view of productivity measurement takes the organization's primary objective and business strategy as given, and begins by defining the customer objectives that underlie the strategy. These objectives reflect the organization's value proposition - how it has chosen to meet its target customers' requirements. For example, an organization that has chosen to compete as a high service provider might define on-time delivery, short cycle times, and after-sales service as the key objectives relating to customers.

Note that these customer objectives are secondary organizational objectives in the sense that they are important, not in their own right, but as a means to the end of achieving the organization's primary objective. Once the customer-related objectives have been identified, the organization must identify an appropriate way of measuring productivity with respect to those objectives. Productivity measurement supports the key roles of monitoring, evaluating, and revising strategy.

Once the organization has specified customer-related objectives and measures, the next step is to identify objectives for the process it uses to achieve these objectives. The process objectives will reflect customer-related objectives and, therefore, the organization's functional strategy. For example, if a key customer-related objective is prompt service, the cycle time will be a process objective. Once the process objectives have been identified, the organization must determine how it will measure productivity with regard to those objectives.

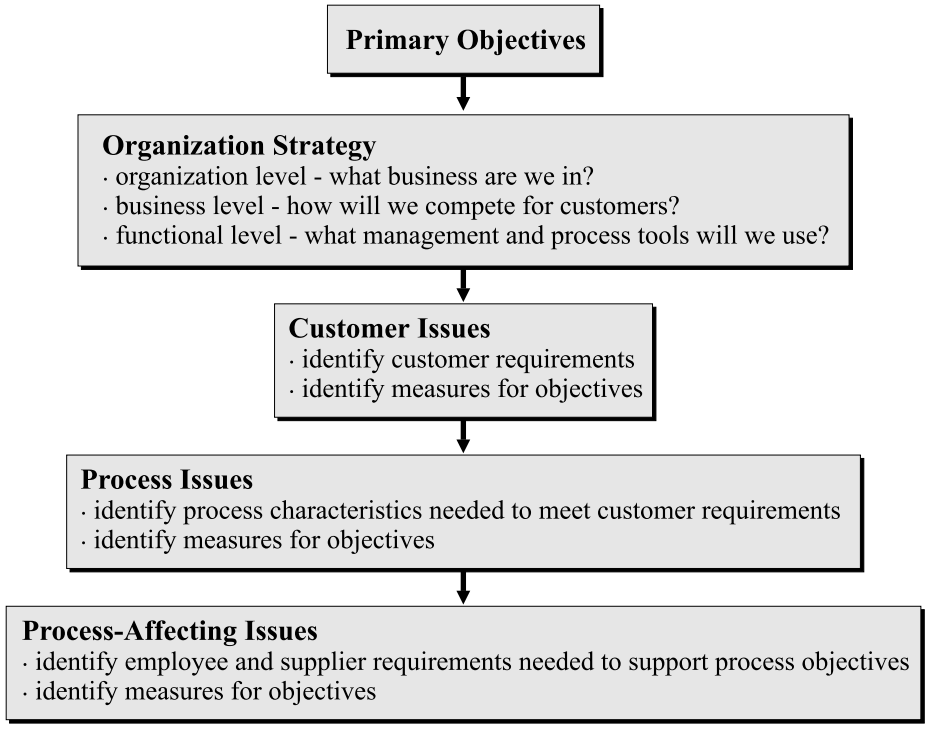
The final step in the process view is to identify other factors that affect process productivity. Employees are one such factor, since their attitudes and motivation will influence the design and operation of the process and, therefore, its efficiency and efficacy. The influence of value chain partners is another potential factor affecting the design and productivity of the value chain. For example, the ability of suppliers to control quality and cost has a profound effect on organizations such as computer and automobile companies, whose primary role is assembling components supplied by other organizations.

The community will have an effect on some organizations in one of two ways: by affecting customer attitudes and, therefore, customer requirements; or by defining requirements or constraints on the process. For example, governments have had an important effect on consumer demand for alcohol and cigarettes and on defining process requirements for industries, such as steel or pulp and paper mills, that have potentially harmful environmental effects. Similarly, for some organizations, public opinion can have an important effect on customer attitudes and, therefore, their willingness to buy a company's products. Public opinion can also have an important effect on process design or operation by creating social expectations - such as affirmative action in hiring or choosing suppliers - thus altering the decisions that organizations would otherwise make.

Each organization needs to identify the set of 'other' factors that affect the productivity of the process it uses to make and deliver goods or services to its target customers. This will allow the specification of objectives relating to these factors. For example, if employee motivation and skill are critical to the design and operation of the process, then employee motivation and skill become important secondary objectives that the organization must manage in order to achieve its primary objective.

In summary, the process view takes the organization's primary objective as given and looks at how the organization's strategy, which selects a target customer audience, creates customer objectives. It also looks at how these objectives, in turn, drive process objectives, whose productivity levels can be affected by other stakeholders such as employees, value chain partners, and the broader community. What is critical is that the process view should be both coherent and internally consistent. Strategy determines what customer-defined attributes become customer objectives. These customer objectives define process objectives. Process objectives define the objectives relating to the factors that can affect the process. In turn, this set of interrelated and coherent customer, process, and other objectives define a set of secondary objectives that the organization must manage to achieve its primary objective. An overview is given in Figure 3.

Figure 3. The Process View of Productivity Measurement



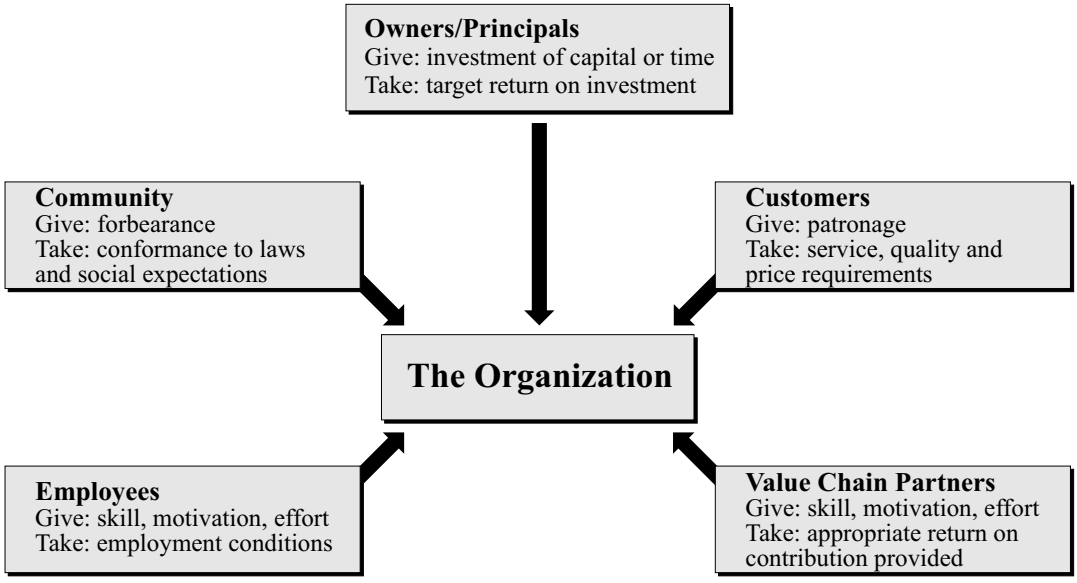
Source: Society of Management Accountants of Canada

The Stakeholder View

The stakeholder view of productivity measurement considers the potential role played by each of five major stakeholder groups - customers, employees, value chain partners, owners, and the community - in defining organizational objectives and helping the organization achieve those objectives. As in the process perspective, the role of the organization's owners or principals in the stakeholder perspective is to define the organization's primary objective. The role of the other stakeholders is defined in terms of how each helps the organization achieve its primary objective. For example, suppliers play an important role by developing highly effective, high quality, and low cost components. Employees provide skill, motivation, and effort to the design, management, and operation of the processes that create the organization's goods and services.

In the stakeholder view, a process of give and take defines the relationship between the organization and each stakeholder group. The organization defines what it requires (takes) from each stakeholder group in order to achieve its primary objective and identifies what it must provide (give) each stakeholder group in exchange. For example, employees give their time and effort and in turn expect to receive market-related wages and work in a satisfying corporate culture. The chain of give and take is depicted in Figure 4.

Figure 4. Stakeholder Relationships: The Chain of Give and Take



Source: Society of Management Accountants of Canada

A nexus of contracts defines these give-and-take relationships between the organization and each stakeholder group, and the give-and-take elements of these contracts are the secondary organizational objectives in this stakeholder view of productivity measurement. For example, an organization committed to a strategy of continuous innovation requires skilled, motivated, and creative employees to generate the continuous flow of products needed to support that strategy. In exchange the organization provides employees with an appropriate compensation system, organizational culture, and management style to elicit the required employee behavior and attitudes. Therefore, secondary objectives arise that relate to the give and take between employees and the organization.

Similarly, secondary objectives would be developed for the organization's other important stakeholder groups. Suppliers provide skill, knowledge, and required components and in return expect to earn a rate of return that is commensurate with what they have provided. The community allows the organization to operate in its midst and in return expects the organization to obey its laws and provide leadership on important social issues.

The productivity measurement system then focuses on developing measures for the secondary objectives identified by the give-and-take relationships between the organization and the various stakeholder groups.

NEW APPROACHES TO PRODUCTIVITY MEASUREMENT IN THE SERVICE SECTOR

Traditional organizations based their business on physical capital while modern ones base it on intangible assets. Knowledge resides inside the employees who convert it into more or less value depending on their capabilities. In order to manage the value creation process, they need modern management methods and new measurement tools. There is no doubt that with Activity Based Costing (ABC) and Economic Value Added (EVA) progress has been achieved in controlling information on business activities. This has seen the beginning of a shift from a focus on cost to a focus on value creation. The introduction of the concept of value added encapsulated the essence of present and future business activities: the domination of input (costs) gave way to output (created value).

However, present accounting systems, although improved by ABC and EVA, remain closely tied to capital employed and financial capital flows. They still lack relevant information on the productivity of intangible resources - how much material, how many employees with a certain level of education and how much time is needed to complete some task. Service output measures can affect and be affected by the unique culture of organizations and the distinct processes and relationships that evolve within them. The propensity for complexity in service organizations suggests that a rigorous approach to measuring efficiency must be adopted.

A number of methods of managing, measuring and reporting on the productivity of intangible resources have consequently emerged and each has taken a somewhat different approach. These approaches are discussed below.

Universal Intellectual Capital Report

Advinsson and Melone have classified intellectual capital measurement indicators into five categories according to their primary focus:

Financial Focus

Indicators that take a financial focus are represented in values or percent. They include standard calculations of return on investment (ROI) and other common financial ratios. However, calculated returns to employees and returns to customers are used to gain a picture of the profitability of the human resources and clientele of the organization. Examples of measures that take a financial focus are as follows:

Financial Measures	
• Total assets ($)	• Market value ($)
• Total assets/employee ($/employee)	• Return on net asset value (%)
• Revenue/Total assets (%)	• Value added/employee ($/employee)
• Profits/Total assets (%)	• Value added/IT employee ($)
• Revenue resulting from new operations ($)	• Return on net assets resulting from new business operations ($)
• Profits resulting from new operations ($)	• Investment in IT/Total investment (%)
• Customer time/employee attendance (%)	• Investment in IT ($)
• Revenue/employee ($/employee)	• Profits/employee ($/employee)
• Lost business revenues compared to market average (%)	• Revenue from new customers/total revenues (%)

Customer Focus

Customer capital includes factors outside the company such as customer loyalty, goodwill and supplier relationships. It is the perception of value obtained by the customer. Techniques used for understanding the value of customers and their perceptions include:

- *Market perceived quality profiles* developed through questionnaires to identify what quality really means to customers, indicating which competitors are best in each area and developing overall quality productivity measures based on the definition of quality that customers actually use in their purchasing decisions.
- *Market perceived price profiles* developed by asking customers to list the factors that affect their perception of products, cost weighting these factors and rating their perceptions of competitors' productivity on each price attribute.
- *Customer value maps* that indicate how customers decide among competing suppliers and products.
- *Won/lost analysis,* which allows an organization to thoroughly analyze the reasons for either winning or losing a competitive bid. If it has won a bid, it can determine which product and service attributes were met and what the relative price/quality conditions were. This approach also offers methods for examining the factors that contribute to changes in market share - that is, quality-price relationships vis-à-vis the competition.
- *What/who matrices* that allow organizations to track responsibility for the actions that will ensure success in providing customer value. The what/who matrix shows an organization which business processes influence its productivity and that of its competitors for each quality attribute. It shows who owns the process that has the greatest influence on the organization's productivity vis-à-vis that of a specific competitor. This business process owner (in the organization) is then responsible for co-ordinating the processes and functions required to improve customer value productivity.

A customer focus specifically addresses the productivity measures related to the customers of the organization. It uses financial, percentage and numerical indicators to paint a picture of such things as the composition of market share, customer service, the demographic characteristics of various customer groups, and the overhead and other support costs required. Metrics for the measurement of customer capital are illustrated below:

Customer Capital Measures	
• Market share (%)	• No. of customers (#)
• Annual sales/Customer ($)	• Customers lost (#)
• Service expense/customer/contact ($)	• Average customer size ($)
• IT investment/service & support employee ($)	• Average time from customer contact to sales response (#)
• Customer rating (%)	• Customer visits to company (#)
• Days visiting customers (#)	• Customers/employee (#)
• Field salespeople (#)	• Sales closed/sales contacts (%)
• Field sales management (#)	• Frequency of change of suppliers (#)
• Satisfied customers index (%)	• IT investment/sales person ($)
• Support expense/Customer ($)	• Service expense/customer/year ($)
• Average duration of customer relationship (#)	

Human Focus

Human capital refers to the know-how, capabilities, skills and expertise of human members of an organization. It is the knowledge each individual has and generates. Key functions of human capital programs include:

- Building inventories of employee competencies;
- Scanning the environment and determining the competencies required to meet objectives;
- Developing systems to deliver the needed knowledge and skills; and
- Developing evaluation and reward systems tied to the acquisition and application of competency that aligns with the organization's objectives.

Measurements that take a human focus are intended to reflect the human capital of the organization and the renewal and development of those resources. They include a number of calculated indexes of employee competency, measures of the elan and potential creativity of the workforce, as well as indicators of the rate at which the human resources of the organization must be replaced. Metrics for the measurement of human capital are as follows:

Human Capital Measures	
• Leadership index (%)	• Motivation index (%)
• Performance against goal/employee (%)	• Empowerment index (%)
• No. of employees (#)	• Employee turnover (%)
• No. of cross functional teams (#)	• No. of managers (#)
• Time in training (days/year) (#)	• No. of women managers (#)
• Average age of employees (#)	• Innovations implemented/employee (#)
• Proportion of employees less than 40 years old (%)	• Average employee years of service with company (#)
• No. of directors (#)	• Employee skill index (%)
• Per capita annual cost of training, communication and support programs for full time temporary employees ($)	• Per capita annual cost of training, communication and support programs for full time permanent employees ($)
• No. of full time/permanent employees (%)	• No. of women directors (#)
• Average age of permanent or full time employees (#)	• Annual turnover of full time permanent employees (%)
• Full time permanent employees who spend less than 50% of work hours at corporate facility (#)	• Per capita annual cost of training, communication and support programs ($)
• No. of full time temporary employees (#)	• Percentage of full time permanent employees (%)
• Average years with company of full time temporary employees (#)	• Average years with company of full time or permanent employees (#)
• No. of part time employees or non-full time contractors (#)	• Average duration of contract of part time employees or non-full time contractors (#)
• Managers with advanced degrees: Business (%), science & engineering (%), finance (%), liberal arts (%)	• IT literacy of staff
	• Cost per hire ($)
• Skill improvement index (%)	• Competence development expense/employee ($)

Renewal & Development Focus

A renewal and development focus includes the measurement of organizational capabilities developed to meet market requirements, such as patents. It is also that knowledge that has been captured/institutionalized within the structure, processes, and culture of an organization. Clearly, every patent, trademark, management tool, improvement technique, IT system, or R&D effort that is implemented to improve the effectiveness and profitability of the organization can fall within the category of organizational (structural) capital. Metrics for the measurement of renewal and development are addressed in the following table:

Renewal & Development Measures	
• Competence development expense/employee ($)	• Direct communication to customer/year (#)
• Satisfied employee index (%)	• New market development expense ($)
• Marketing expense/customer ($)	• Non-product related expense/customer ($)
• R&D expense/administrative expense (%)	• Industry development expense ($)
• Share of development hours/total working hours (%)	• Average age of company patents (#)
• Share of training hours to total working hours (%)	• Patents pending (#)
• New ideas implemented (#)	• Value of EDI/E-commerce system ($) and upgrade to EDI/e-commerce system ($)
• Employees' view (empowerment index) (#)	
• Training expense/employee ($)	• E-commerce investment/total investment (%)
• Training expense/administrative expense (%)	• No. of suppliers liked with EDI (#)
• Business development expense/administrative expense (%)	• Ratio of new products (less than two years) to product family (%)
• Payroll share of employees below age 40 (%)	• Relative R&D investment in basic research (%)
• IT development expense/IT expense (%)	• Relative R&D invested in product design (%)
• IT expense on training/IT expense (%)	• Industry awards won (#)
• R&D resources/total resources (%)	• Relative R&D invested in process improvement (%)
• Customer base (#)	• Average time to process payments (days)
• Average customer age/education/income	• Average time to make purchases (days)
• Average customer duration with company (months/years)	• No. of papers presented at seminars/symposiums/public forums (#)
• Training investment/customer (#)	• Staff involved in business intelligence (#)
• No. of strategic business partners (#)	• No. of benchmarking studies undertaken (#)

Process Focus

Processes are structured and measured sets of activities (such as shipment or procurement) designed to produce specific outputs for the customer or market. Identifying an organization's value creating processes (where knowledge is created, integrated, transformed and utilized) requires a horizontal view across functional relationships. Identification of a process and analysis of each of its activities (for example, placing the order, receiving the goods and making payment) is done through the creation of a model. This provides insight into the flow of information, the flow of knowledge, and the characteristics of knowledge transformation between individuals, departments and throughout the organization. The end product of a process focus is identified and valued as improvements in organizational efficiency and measured by cost savings, profits, revenue growth, return on investment or improved innovative capabilities, through a variety of individual and team based performance indicators. Some of the key metrics to measure the efficiency of a process are given below:

Process Measures	
• Administrative expense/total expense (%)	• Administrative expense/revenue (%)
• Cost of administrative error/total revenues (%)	• IT capacity (CPU & DASD) (#)
• Process time, out payments (#)	• Change in IT inventory ($)
• Contracts filed without error (#)	• Corporate quality goals (#)
• Function points/employee-month (#)	• Corporate performance/quality goals (%)
• PCs/employee (#)	• Discontinued IT inventory/IT inventory (%)
• Laptops/executive (#)	• Orphan IT inventory/IT inventory (%)
• Administrative expense/employee ($)	• IT capacity/employee (#)
• IT expense/employee ($)	• IT performance/employee (#)
• IT expense/administrative expense ($)	• Average repair time (#)
• Time taken to enter into contracts ($)	• Average response time to customer call (#)
• No. of people involved in executing contracts for values up to $500 and above (#)	• Time taken from initial requirement to receipt for items up to $50 & above (#)
• Time from project initiation to execution (#)	• Date when last process review undertaken
• IT expense/employee ($)	• Corporate quality performance (ISO 9000)
• Time for each process cycle completion (#)	• No. of suppliers/service providers (#)

Measuring Primary Cost Drivers (Activity Based Management)

Dissatisfaction with traditional measurement systems has driven the movement towards activity analysis and the associated development of activity based cost management. This method identifies resource usage in the various activities of processes in non-financial areas. It addresses the perceived needs of customers in at least four areas - cost, quality, time and innovation - all of which require simultaneous satisfaction, as indicated below:

Area	Action	Analysis
Cost	• Lowering cost	• Cost behavior
Quality	• Higher quality	• Factors inhibiting performance
Time	• Faster response	• Bottlenecks/Inertia
Innovation	• Greater innovation	• New product flexibility

Extensive data collection on the non-financial indicators is necessary in each of the cost/quality/time/innovation areas. This makes considerable demands on the time of those involved, necessitating widespread co-operation and participation. Commitment to change must come from the top. The drivers in each of the four areas are discussed in the following sections.

Cost Drivers

We need proper allocation of costs to products/services to have a complete picture of cost assurance. In the service sector, direct costs (such as materials) are usually not a major input factor but indirect costs are. A focus on costs, processes and activities fulfils a vital function in classifying different cost patterns, examples of which are given below:

Area	Measure
Quality of input	• Actual vs target
Equipment productivity	• Actual vs standard usage
Maintenance efforts	• Time spent on client maintenance
Overhead costs	• Cost/total revenue
Product complexity	• Time composition for each speciality
Quantity of output	• Cost for managing output
Employees	• % turnover
Employee productivity	• Actual vs target time
Customer focus	• % calls; % complaints
Quality of output	• Customer satisfaction

Quality Drivers

The pursuit of quality demands that we identify all non-value-adding activities in processes and implement procedures to eliminate or at least reduce them. The cost of quality output is the essential ingredient in the long-term value creation of the organization. The classification of quality costs is useful to allow closer examination of the drivers of quality and measurement of related productivity. The costs of prevention, appraisal and failure are aspects of the cost of quality.

Prevention costs include the cost of equipment, product and process planning, preventive maintenance, training, and implementation of statistical process control. Appraisal costs include the cost of inspection and testing and that of maintaining and administering appraisal systems and equipment. Failure costs relate to customer goodwill and the organization's reputation. The main quality drivers are given below:

Area	Measure
Network strength	• % of business done with strategic partners
Co-ordination failure	• Meetings & calls attended to address the issues
Reliability	• Repeat customer business • Customer referred business • % delays in delivery of service
Availability	• Time to respond to customer expectations
Employee morale	• Employee satisfaction • No. of new suggestions from employees
Leadership impact	• Market & employee image of leadership
Customer awareness	• % delay in delivery of service

Time Drivers

Time is of the essence in providing services that meet the expectations of customers. According to research, process time accounts for less than 10 percent of total delivery time and 90 percent of the time is associated with the addition of cost rather than value. Dependable and fast delivery of services is one of the top priorities of service organizations. A large number of productivity metrics can be developed in this area, including the following:

Area	Measure
Project implementation	• % of projects delivered on time
Service flexibility	• No. of services provided relative to competition
Staff effectiveness	• Knowledge of customer requirements
Customer impact	• % of overdue services • Mean service delivery delay

Innovation Drivers

The creative powers of the workforce must be harnessed to encourage innovation at all levels. Total employee involvement helps to develop responsible attitudes in the workforce and ensure that the ideas of frontline employees are listened to and, wherever possible, acted upon. By making the best use of the experience and intellect of those closest to the work processes, innovative solutions may be developed in identified problem areas. Innovation may involve pure or applied research, developmental application, new product/service development, operational/process development and cost reduction techniques. It also demands the development of a new range of metrics, of which the following are typical:

Area	Measure
Ability to introduce new products	• % product obsolescence • No. of new products launched • No. of patents secured • Time to launch new products
Flexibility to accommodate change	• No. of new processes implemented • No. of new process modifications
Reputation for innovation	• Media recognition for leadership • Expert assessment of competence • Demonstrable competitive advantage
Learning capabilities	• No. of presentations at conferences/seminars/symposia • Involvement of colleges/universities and research institutions

Cash Flow Measures

Cash flow is increasingly used as a measure of performance on the grounds that profits and earnings may be a matter of opinion, but cash is a matter of fact. One measure is cash flow return on investment, arrived at by converting profitability data into cash flow and using real gross assets as a surrogate for investment. Shareholder value added measures net operating profit after tax and the cost of capital invested in the business. A related cash value-added approach measures past and projected cash flows from strategic and non-strategic investments.

Cash flow measures can be very useful in special circumstances such as when a company is in financial distress or in high-tech start-ups with a high investment in intangibles, e.g. biotechnology companies.

Economic Value Added

Economic Value Added (EVA) was developed in the 1980s by Stern Stewart & Company as an indicator of returns to shareholders. It aims to strip out many of the anomalies of the accounting system by presenting a simpler measure of the difference between the cost of capital and profit. A related measure, Market Value Added (MVA), compares total market value (less debts) with the money invested in the firm in the form of share issues, borrowings and retained earnings. EVA is designed to focus managers on the cost of the capital they use and so encourage them to generate more value from the assets they manage. Stern Stewart estimates that balance sheets often need restating, however, to give an accurate picture of the capital employed in the business and often this involves adding in intangibles.

EVA has become a common tool amongst world class organizations. Critics argue, however, that it is still too historical a measure and does not provide any sense of the linkages between an organization's investment in intangibles and its financial performance. It has also been criticized for being biased against investments in intangibles.

The Balanced Scorecard

Robert Kaplan and David Norton first described the Balanced Scorecard in a *Harvard Business Review* article in 1992 and in their subsequent book on the subject. The scorecard measures the performance of a business in relation to its strategy by means of an integrated set of financial and non-financial measures relating to critical success factors. It aims to balance financial measures of performance, such as cash flow and return on capital employed, with measures of innovation and renewal (percentage of revenues from new products, the R & D success rate), measures of internal processes (cycle times, quality and productivity) and measures of customer satisfaction and retention. It is principally a management tool to allow executives to measure the effectiveness of their business strategy in delivering financial results.

The attraction of the Balanced Scorecard is that, when properly designed, it should allow managers to view at a glance the key indicators of business performance and their linkages. Each organization has a unique vision, strategy, goals and objectives and its Balanced Scorecard needs to be developed from these. The relevant perspectives and their relative importance can be expected to vary from firm to firm. Also, even though an organization may be primarily interested in the financial perspective, in drawing up its scorecard it will identify many goals and measures from other perspectives that will amplify the financial goals.

The Balanced Scorecard concentrates corporate attention on innovation in performance measurement. This is useful because traditional management reporting systems are not of much help in measuring performance in the new service and knowledge economy. These backward-looking 'task' or 'cost objective' oriented measurement systems generate results by entity, lines of business, and cost and profit centers but fail to supply the information necessary to pull strong future performance out of the organization. Today's managers know that yesterday's accounting results tell little about what actually can help grow market share and profits - things like employee development, innovative service that enhances customer value, the quality of vendor services, and benefits from advancements in research and development.

The key advantage of the Balanced Scorecard is that it puts strategy and structure at the center of management's focus. It emphasizes an integrated combination of traditional and non-traditional performance measures and also keeps management focused on the entire business process while helping to ensure that the actual current operating performance is in line with the long term strategy and customer values. In doing this, the Balanced Scorecard helps maintain a balance between building long-range competitive ability and recognizing investors' attention to financial reports. While it does retain financial measures, these are viewed in the larger context of the organization's investment in customers, suppliers, employees, processes, technology and innovation.

European Foundation for Quality Management Model

This model relates a wide range of weighted non-financial measures to business performance. It is based largely on the model used by the Malcolm Baldrige Award for Quality in the US. The model identifies enablers - such as leadership and the management of people, resources and business processes - and results, which include customer satisfaction, employee morale and business results, as well as impact on society. It aims to give a more complete picture of the process through which an organization sets strategy and manages its assets to deliver business results.

Institute of Chartered Accountants of Scotland Model

In 1993 the Institute published a review of performance measurements used by managers. The model is based on three main ingredients: supply, demand and corporate responsibility/governance. In the supply category are measures of financial health (such as stock market ratios), human capital (such as education and training, recruitment and retention), physical plant and equipment, and natural resources and environmental impact. The demand category includes customer satisfaction, customer profile and market share, while corporate governance embraces compliance with laws and regulations and the corporate governance structure. Many of these performance measures are used by British companies.

Ethical and Social Auditing

An organization's performance increasingly depends on its relationships with key stakeholders and partners - among them employees, customers, suppliers, the local community and pressure groups. These relationships, which are by their nature intangible, are among the organization's most valuable assets and mould market perceptions. Relationships with suppliers, customers and employees, for example, are vital to business performance. Relationships with pressure groups and the community may be critical in determining an organization's public standing and reputation. Successful organizations have strong relationships with partners, suppliers and employees and a sense of social responsibility.

The argument behind social and ethical auditing is that to audit an organization comprehensively one would have to audit these relationships. Organizations should engage in lengthy consultation with the representatives of the various stakeholder groups to ascertain their judgements of measures that should be used to assess performance.

Environmental Auditing

The auditing of an organization's impact on the natural environment is increasingly common, especially for large companies in environmentally sensitive industries such as oil and chemicals. Environmental auditing is being driven by a recognition that an organization's ability to recruit and retain staff and customers in large part depends on its public standing and reputation. Environmental responsibility is a key ingredient of this public standing. While this is not directly pertinent to service organizations, it is incumbent on them to develop services that improve their image and address the growing demand for environmental sensitivity.

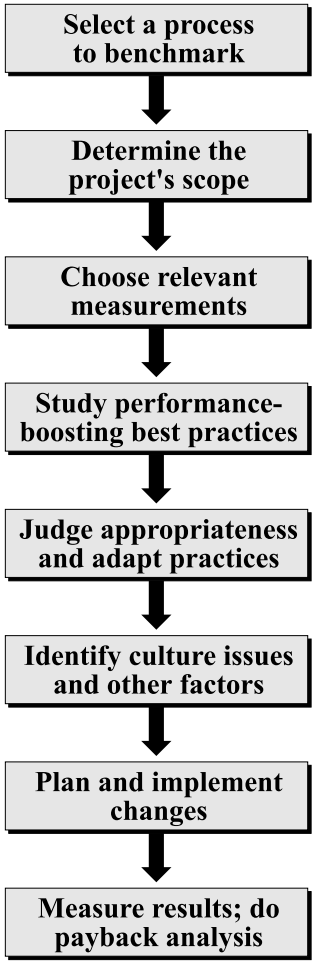
Benchmarking

Benchmarking is a tool that enables breakthrough operational improvements by identifying and deploying the best practices of world class organizations. It can take any of the following four major forms:

- *Internal benchmarking* - The comparison of processes within the same or parent organization;
- *Competitive benchmarking* - The comparison of organizational processes with those of direct competitors;
- *Functional benchmarking* - The comparison of similar processes in companies with other industries; and
- *Generic benchmarking* - The study of innovative methods, techniques or technologies that can be used in a variety of business processes.

The benchmarking process is depicted in Figure 5.

Figure 5. The Benchmarking Process



CHALLENGES IN THE MEASUREMENT OF SERVICE OUTPUTS & THE APPLICABILITY OF TRADITIONAL ACCOUNTING METHODS

According to current trends, manufacturing and agriculture will progressively account for less and less of output and employment globally. Information technology has become pervasive, in production processes and in products, many of which have become more technologically complex as a consequence. Less and less economic activity involves the manipulation of physical commodities; more and more economic activity involves processing and analyzing information, making judgements, providing services and manipulating images. Science is breeding entirely new industries and families of products, such as biotechnology and nano-technology. Two very powerful trends are combined in these developments:

- First, a growing share of what we produce and consume is 'immaterial': information, judgement, analysis, service, entertainment, or advice. The assets we use to produce these immaterial goods are increasingly immaterial as well. We increasingly rely on information technology, software, design and personal skills.
- Second, the generation, application, orchestration and exploitation of knowledge is becoming critical to how organizations, regions and economies develop and sustain competitive advantage. Organizations must base their competitiveness on assets which are distinctive, durable and which they can replicate and appropriate, but which their competitors find hard to imitate. In an increasingly open world economy, in which intermediate input markets for components have proliferated, it is increasingly difficult for organizations to sustain their competitiveness on the basis of traditional assets: land, raw materials, machinery and cheap labor. In an open economy most of these traditional physical assets are available on equal terms to competitors. Organizations increasingly base their competitiveness on intangible assets, capabilities and competencies, which consumers value and which competitors find it hard to copy.

One consequence of these two forces is that the efficiency of different factors of production is becoming increasingly difficult to measure reliably and accurately. The following are problems associated with accounting for productivity in the service sector:

The Scale of Intangibles

One measure of the growing scale of intangible assets is the gap between the value of a company's tangible assets recorded on its balance sheet and its stock market value. This ratio, known as the 'market-to-book-ratio', has grown especially large for service and high-technology companies. According to a *Business Week* report (July 10, 2000) only about 12 percent of Intel's stock market value is accounted for by traditional, tangible assets - land, buildings, machinery, equipment - recorded on its balance sheet. The missing 82 percent of the company's value accrues to intangible assets: brands, research and development, and people. This trend is not confined to high-tech companies.

Although business surveys suggest that managers believe intangibles are increasingly critical to their companies' performance, these assets are rarely recorded on balance sheets or listed in annual reports. This suggests that market-to-book ratios may have risen in part because book valuations have been slow to adapt to the changing asset base of modern businesses.

Rate of Change Driven by Intangibles

Accelerating change spreads uncertainty and makes it increasingly difficult for accountants to match a company's investments and expenses in one period with its earnings and income in another period. Earnings in one accounting period are increasingly a poor guide to earnings in a subsequent period. This faster rate of change is in part due to deregulation and technological change, which has exposed companies to new competition and opened up new markets which are difficult to value. However, investment in intangibles - research and development to create new products for example - also plays a significant role in driving change and at the same time creates challenges for measuring the productivity of intangible assets.

Accounting systems are slow-moving and typically historical in outlook. They are not good at dealing with volatility, uncertainty and change. Yet increased investment in hard-to-value intangible assets produces just that. The problem is not just that the productivity of intangible assets is hard to measure; the problem is the rapid rate of change they produce. Traditional financial information - earnings, cash-flows, book-values - has become less relevant to stock market valuations. This has come about largely because the rate of change in business performance has accelerated so markedly in the last 20 years.

Inadequate Measurement of the Productivity of Intangibles

As discussed earlier, there is a growing consensus that purely financial measures do not paint a complete picture of the strengths and weaknesses of a company. Yet for all their alleged weaknesses, financial measures are still the most widely used, both inside and outside companies. There are some good reasons for this: rules for public disclosure to investors put an emphasis on financial measures; financial information is easily comparable; companies are wary of disclosing more information because they worry about giving away a competitive advantage.

Accounting systems are primarily based on the recording and reporting of discrete, transaction-based events, such as sales, purchases, investments, cash receipts and disbursements. In contrast, changes in business performance are rarely triggered by specific transactions and are often continuous rather than discrete. These changes may affect the value of a company long before their impact on revenues and costs recorded by accountants becomes apparent. When rapid and significant changes in business performance are driven by investment in intangibles, the difficulties of accounting for change are compounded. The starting point for developing new measures for intangibles is to understand the drawbacks of over-reliance upon purely financial measures. What is needed is a more comprehensive approach that will help to value intangibles but also eliminate these drawbacks.

Incentives for Knowledge Workers and Entrepreneurs

The current approach to accounting for the productivity of intangible assets makes it difficult to unravel the contribution that different people and occupations make to a business. As a result it is difficult for knowledge workers to assess their true worth and what rewards they should receive. They face the risk that they may give away their knowledge capital to their employers too cheaply, allowing companies to profit from the under-valuation of their human capital. For example, when IBM estimated the value of Lotus's R & D in progress as worth about US$1.84 billion, this was mainly made up of the ideas and human capital of the employees. These knowledge workers were probably relatively well paid, but they may not have calculated that they were collectively worth almost $2 billion dollars. Better information about the value of people and their ideas would reduce the information asymmetry between managers and workers, which managers can in theory exploit to their advantage.

Inadequate Disclosure of Intangibles

The unregulated disclosure of information about intangible assets can create quite a different problem. Without proper regulation of such disclosure, it may be possible for companies to manipulate perceptions of their value, leading investors to over-value them. Thus the inadequate disclosure of information may distort allocation of capital between various sectors.

Inadequate disclosure concerning the quality of intangible assets may feed volatility and uncertainty in capital markets. The roller-coaster of exploding and then collapsing stock prices does not help investors to plan and makes the process of allocating capital between different industries more fraught. This volatility might be eliminated with improved disclosure requirements, especially for knowledge-intensive, listed companies.

Inadequate disclosure of intangibles does threaten significant harm, especially as economies become even more knowledge intensive. It can exacerbate information asymmetries to the benefit of insider traders and to the disadvantage of ordinary investors. It can create information asymmetries within companies, to the advantage of managers and shareholders and to the disadvantage of knowledge workers who might under-value their work. Volatility and uncertainty make it harder for capital to be allocated efficiently. Compensation systems designed to reward individual contributions require finite measures. The challenges to productivity measurement are profound:

- The ability of a company to develop finite measures of intellectual capital is directly proportionate to the ability of its systems to support the capture, retrieval and coalescing of data.
- Gross measures of intangible assets, while interesting, provide less opportunity to leverage the productivity of knowledge than more finite measures.
- Measures of intangibles are directly reflective of a company's work process and systems and thus are difficult to compare on a relative basis either across companies or across industries.
- Longitudinal measures (over a long period of time) are most appropriate for guiding intangible investment and its relative productivity or ROI.
- Measures are needed to capture many of the characteristics that make companies a success, including employee morale, dynamic and forward-thinking leadership, and an environment that supports innovation and creativity. These measures are not needed as a replacement for traditional accounting but as its predecessor, a predictive function that accounting - always a descriptive discipline - has never had before. They need to work as a navigation tool at the front end of the accounting model.

David J. Teece, Professor of Business at the University of California at Berkeley, explains why intensified competition in liberalized markets has made the productivity of intangible assets so valuable:

> "*The decreased cost of information, the increase and spread in the number and range of markets in which companies can buy production inputs, the liberalization of product and labor markets and the deregulation of financial flow, is stripping away traditional sources of competitive differentiation and exposing a new fundamental core to wealth creation. That fundamental core is the development and astute deployment of intangible assets, of which knowledge, competence and intellectual property are the most significant. Other intangibles such as brands, reputation and customer relationships are also vital. Special access to natural resources and skilled labor, economies of scale and scope, are fading as sustainable bases for competitive advantage. In the end, wealth creation in a world of heightened competition comes down to developing, orchestrating and owning intangible assets which your competitors will find it hard to imitate but which your customers value."*

Companies increasingly need strong, distinctive internal capabilities. However, a company's distinctive know-how has to be combined with complementary assets, resources and skills provided by partners, investors and suppliers. A bright idea for a new product has to attract finance to research and develop it; it will require skills and investment to make it and different capabilities to market it effectively. How to measure the productivity of intangible assets is one of the major challenges facing service organizations.

PRODUCTIVITY MEASUREMENT IN THE HOSPITAL INDUSTRY - CASE STUDY

The productivity of the service sector is extremely difficult to measure effectively because of the multiplicity of inputs and the magnitude and complexity of the output. This creates a so-called 'productivity paradox'. Our traditional measures of accounting for productivity were primarily designed for the industrial age and do not offer much insight for meeting the challenges of a complex knowledge and technology-intensive business environment. Peter Drucker in his landmark book *Managing in Times of Great Change* has rightly remarked:

> *"We still do not have cost and productivity control tools in services: schools, banks, labs, hospitals, architectural firms and so on. We know how much a service takes in, how much it spends and on what. But we do not know how the spending relates to the work the service organization does and to its results - one of the reasons that the costs of hospitals, colleges and post offices are out of control. Yet in every developed country two thirds to three quarters of total output, employment and costs are in services."*

Thus productivity measurement in the service sector is fraught with challenges because, in contrast with cost accounting in manufacturing, cost accounting for services has to be top-down, starting with the cost and output of the entire system over a given period of time. Quality and productivity are as important to costs in services as is the quantity of output. In most services, teams are the cost centers and focus of output rather than individuals or machines. But most needed - and often totally lacking - are the measurements to give us business control. According to Drucker:

> *"Financial accounting and so forth are an x-ray of the enterprise's skeleton. But much of the disease we most commonly die from - heart disease, cancer, Parkinson's - does not show up in a skeletal x-ray; a loss of market standing or failure to innovate does not show up in accountants' figures unless the damage has gone beyond repair."*

Attock Hospital was previously part of Attock Refinery's support function and had been providing services for more than 78 years in a traditional manner. To meet its social objectives, in August 1998 the hospital operation was converted into a wholly-owned subsidiary of the refinery. Exposing the hospital staff to the service paradigm was like pulling fish out of an aquarium and throwing them on the ground. They were not accustomed to this environment and they started facing problems in delivering quality service, while the accompanying culture change was also a big challenge. They were pushed to justify any new capital and revenue expenditure in terms of ROI and the relative improvement in value added that it would generate. The doctors and paramedical staff were perplexed with this shift, as they did not have any inkling of the concept of ROI and accounting concepts or productivity measurement.

The management soon realized that the success of the hospital was heavily tied to knowledge and the ability of the employees to transform it into profitable action. Depending on their capabilities, it was now possible for the same number of staff to achieve completely different business results, in contrast to prior times when a given amount of routine work produced more or less the same quantities of outputs. The challenge was therefore to establish a different evaluation system for business success focusing on value addition in the hospital and not on cost control.

Accordingly, to protect themselves against the vagaries of competition, the doctors started developing strategies for bringing the hospital from infancy to adulthood by sensing the needs of different customer segments. In terms of meeting objectives, the main focus was on the productivity of intangible resources arising from human capital (employee/manager and leader know-how, experience, education, etc.). This was eventually translated into structural capital (strategic processes or work processes), and customer capital (alliances, customer relations and brand image).

An intellectual capital task force focused on key value creation disciplines within the company and attempted to identify specific measures of productivity related to these disciplines. The challenge was to understand the key 'inputs' such as education, compensation, training and experience and how those inputs related to an individual's ability to efficiently meet customer needs. In other words, what aspects of intellectual capital related most directly to productivity? The project hypothesis was that the correlation of desired outcomes with required inputs would result in more appropriate channeling of recruitment, training and motivation programs, thereby providing the company with a human resources edge in an increasingly competitive industry.

With a view to installing initial control measures, a new tool called the 'wellness report' was introduced. This showed key financial and non-financial areas to enable staff members to watch the figures and change work processes and methodologies so as to raise the bar relating to improvement in the productivity and quality of services.

Development of the Business Plan

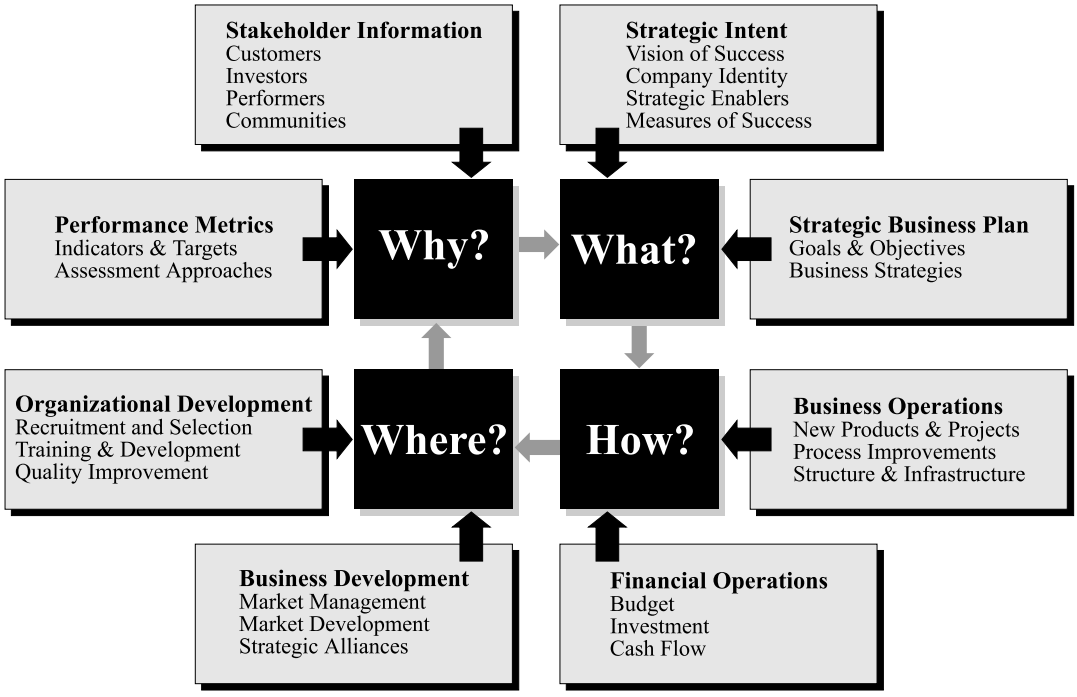
In the last two years, the company has strategically recognized the importance of its intellectual capital assets as a key ingredient of its business success. It has developed a long-range strategic plan for organizational development and is now in the process of executing the plan. It has adopted the Balanced Scorecard approach, which integrates and aligns human resources and organizational strategies/processes with the business plan and direction. There is a conscious recognition that all these elements working effectively together should contribute to satisfaction among customers and employees. This, in turn, will increase revenue and profit and sustain long-term business growth for the company.

Considerable progress has been made in the development and integration of organizational strategies and processes as they relate and contribute to overall company business performance. Although there are still many challenges ahead, the key ingredients of this progress have been a clear, compelling vision and strategy that is integrated with the business plan, committed executive leadership, the ability to measure the return on investment, and the education of service providers regarding their role in stewarding intellectual capital assets.

The objective of the strategic plan is to maximize the effectiveness, performance and productivity of the organization and its people and support its strategic business goals. It integrates all current and ongoing organizational development initiatives and provides a strategic framework for implementing plans across the organization. It also ensures that appropriate resources (particularly financial resources) are allocated to support strategic organizational development initiatives such as integrated service development, training, leadership development, and key technical skill development.

The plan includes the key metrics that will be used to measure the effectiveness of organizational development initiatives, the payback to the company and the contribution to business competitiveness. The strategic plan for organizational development engages and establishes the support of key stakeholders across the organization and creates an organizational development leadership network. The members of the network develop the plan and work collectively to implement effective strategies that move the organization's business forward, as illustrated in Figure 6.

Figure 6. The Attock Hospital Business Framework



Adoption of New Measures

After successful testing of the wellness report, the need was felt for a comprehensive tool to gauge the performance of all the significant parts of the organization. After exploring various possibilities, the Balanced Scorecard approach was adopted, as already mentioned. Management endeavored to design performance goals - for keeping score - based on the organization's unique needs and perceived critical success factors. It was felt that restructuring not only requires innovation in the way organizations view and measure performance, but developing, implementing and evaluating such measures and matching them to the employee compensation system may be the greatest challenges that have to be faced.

The Balanced Scorecard was divided into five perspectives, most of which are still in the implementation phase. These are discussed in the paragraphs that follow.

Customer & relational perspective

It is believed that success lies in paying attention to the needs and desires of patients - the customers. They pay the hospital's costs and provide its profits. Accordingly there was a need to identify the customer and market segments in which the hospital needed to compete. This perspective allowed alignment of measures of customer values (i.e. satisfaction, loyalty, retention, acquisition and profitability) with targeted customers and market segments. Selected productivity measures in this area are given below:

Customer & Relational Perspective		
Objective	**Measure**	**Data source**
Customers & Suppliers		
Timely access to services	• Time to provide service vs target • Growth in business volume • Proportion of revenue by repeat patients	Admin data
Customer satisfaction	• Repeat treatment (not normally expected) as % of total patient visits • % of customer defection (6 month time frame)	
Improvement initiative	• No. of benchmarking projects	
Network improvement	• No. of alliances with other hospitals for effective patient care • No. of consultants on call • Proportion of suppliers' business that our services represent (money terms) • No of customer/supplier networks	
Communication (between providers & patients for better outcomes)		
Satisfaction with number of doctors to choose from	• No. of patients seeking referral/doctor	Patient survey
Co-ordination of care to ensure efficiency & effectiveness of medical management process	• Time of action vs standard	Admin measures
Doctor communicates well with patients (to meet patient expectations of healing process and compliance with professional ethics)	• Patient reports that doctor listened carefully to them, explained their medical condition in a way they could understand and involved them as much as they wanted in decisions about their medical care	Patient survey
Doctors treat patients with respect (to build trust in the hospital)	• Patients who report that their doctor took their medical condition seriously and treated them with respect	Patient survey
Doctor seeks to understand work environment (understanding the constraints and demands on the patient helps the doctor plan the most effective treatment, thereby increasing the likelihood of successful return to health)	• Survey respondents who report that their doctor tried to understand their daily job tasks and duties and understood how their health would affect their ability to do their jobs	Patient survey
Outcome to employers (for effective clinical management & minimizing illness due to working conditions)		
Initial return to work (to use this measure to assess the effectiveness of medical management strategies)	• Distribution of lost days (by employer in terms of productivity) and the average length of time from date of illness to first return to work	Patient survey
Premature return to work (to ensure that doctors follow best practices to result in patients' returning to work at an appropriate time)	• Patients who report that they went back to work too soon	Patient survey
Returned to work but had additional lost time (to ensure that care management approaches are effective in achieving sustained return to work)	• Patients who report that they lost additional time from work after returning to work (excluding time off for medical appointments)	Patient survey
Work-related functioning post illness (to ensure that providers are able to achieve optimal functional outcomes)	• Patients who report that their work-related functioning post illness is about the same or better than prior to their illness	Patient survey

Outcome to employers (continued)		
Objective	**Measure**	**Data source**
Time to return to work (This measure helps the providers understand the patterns underlying cost and utilization outcomes that result from medical management.)	• Distribution of lost time by interval between illness and return to work: percent within 30 days, within 60 days, within 180 days, and within 18 months (cumulative percentages)	Patient survey
Lost time days (This measure provides information on the effectiveness of medical management and care co-ordination, including co-ordination with employers.)	• The total cost incurred by employers for lost time days	Patient survey
Cost to employers	• Cost per patient and dependants • Patient-wise detailed cost break-down • Costs by nature of illness • Cost per employee age group • Preventive cost (by nature of illness)	Admin data
Patient satisfaction (relative to early return to work and network of acceptable providers for effective care)		
Satisfaction with most frequently seen physician (If satisfaction rates are low, the providers may wish to look more closely for correctable reasons for dissatisfaction.)	• Patient rating of their overall satisfaction with the medical care they received from the doctor they saw most frequently	Patient survey
Changing doctors (If change rates are high, the providers may wish to look more closely for correctable reasons for dissatisfaction.)	• Percent of patients who report changing doctors at any time during their treatment because they were dissatisfied	Patient survey
Satisfaction with doctor (If satisfaction rates are low, the providers may wish to look more closely for correctable reasons for dissatisfaction.)	• Patient rating of their overall satisfaction with their case doctor, among patients who report having a specific doctor	Patient survey
Satisfaction with medical services (If satisfaction rates are low, the provider may wish to look more closely for correctable reasons for dissatisfaction.)	• Patient rating of their overall satisfaction with all the medical care they received during their illness	Patient survey
Illness prevention counseling (Low rates may be an opportunity for work with providers to improve their prevention counseling skills, or to provide direct patient education on illness prevention.)	• Patients who agree or strongly agree that their doctor provided information on how to prevent recurrence of their illness	Patient survey
Appropriate clinical care (appropriate assessment, diagnosis & counseling during initial clinical visits)		
Adequate medical history	• The number of patients with an adequate medical history, including history of trauma, documentation of specific conditions and nature of complaint	Medical records
Occupational risk assessment	• The number of patients with an occupational risk assessment, including a work history and a physician determination of work relatedness	Medical records
Appropriate focused physical examination	• The number of patients with a focused physical examination, specific to the illness type	Medical records
Appropriate work restrictions	• The number of patients with appropriate work modification specific to the illness type and employer notified	Medical records
Attempt to place on modified duties	• The number of patients for whom the doctors contacted the employer to arrange modified duties, if indicated	Medical records

Appropriate clinical care (continued)		
Objective	**Measure**	**Data source**
Appropriate patient education (to provide training to doctors to ensure they carry out and document education to promote the best outcomes)	• The number of patients who received appropriate patient education, specific to the illness type	Medical records
Reassessment if illness unimproved (work with providers to ensure that they manage cases proactively)	• The number of patients receiving a repeat history and physical examination if the illness is unimproved or worsening	Medical records
Doctor counsels patient about managing the illness (to offer supplemental training for network physicians in occupational medicine techniques)	• Patients who report that their doctor discussed what activities they could do, how to manage pain, different treatments, side effects of medication, and when they could return to work	Patient survey

Serving the local community is a key strategic objective, and thus a second focus of attention is the perceived needs of the community. Since the local community falls into the low and middle-income range, the strategy has been built around meeting the low cost needs of this important customer segment while at the same time maintaining high service quality.

Another critical area of attention is the employees, whose innovative service, know-how and capability are essential to the success of the hospital. Management's explicit identification of the employees' perspective reflects its belief that a well-paid and satisfied workforce is key to attaining the company's overall goals and objectives. Selected productivity measures for the community and employee perspective are given below:

Community & Employee Perspective	
Objective	**Measure**
Support services for needy patients	• No. of patients attended free of charge
General services	• No. of free eye, ENT or other camps arranged
Awareness of seasonal diseases	• Awareness sessions arranged & related cost and benefit to community • No. of pamphlets issues regarding growing/ seasonal diseases
Specific care	• Reduced rate services for patients from adjacent areas (subsidy cost)
Community satisfaction	• Community surveys
Competitive salaries & benefits	• Salaries compared to norm in the area
Employee competency	• Reputation of company with head-hunters • Reputation of doctors/consultants in the market • Years of experience in profession • Employee satisfaction/motivation • Proportion of challenging assignments • % of employees with degrees • IT literacy of staff • Staff turnover • Proportion of employees suggesting new ideas (implemented) • Rookie ratio (% of employees with less than two years' experience) • Profit/employee
Development considerations	• Training cost/employee • Value added/employee • Value added/$ of salary
Strategic success indicators	• Leadership skill (executives)

Internal matters such as the management philosophy, corporate culture, management processes, information systems, networking systems and financial relations are the backbone of organizational success. The internal component of the hospital's Balanced Scorecard focuses on internal business processes to deliver the objectives that the customer and community perspectives have established.

The objective of this perspective is to expand the focus beyond improving existing operating processes to defining a complete internal process value, identifying current and future customer needs and developing solutions for those needs. The aim is to enhance internal capabilities and investment in systems, procedures, and processes as well as the procedures necessary to improve future performance. The metrics for measuring this area have been developed, with due attention to the company's unique requirements, to identify the complete chain of processes that add to the value customers attach to the hospital's services. Selected productivity measures in this area are indicated below:

Internal Perspective	
Objective	**Measure**
Efficiencies of service processes	• Cycle time, overhead cost as % of revenues • No. and quality of customers • No. of patients seen by each doctor • Time spent on project by each member
Low cost of patient care (to better service local community)	• Unit cost vs competitors
New services	• No. of new services vs target
Cost effectiveness	• Variable/fixed cost per outpatient/inpatient • Other costs/patient/service unit relative to competition • Employee input/unit of service (for internal benchmarking)
Time factors	• % on-time arrival of doctors • % of meetings delayed • % delay vs total time of meetings • Time spent on managing process improvements

The fourth perspective reflects the importance of organizational learning as a critical success factor. Implemented within the 'learning organization' philosophy, it will require an overall strategy with clear and well-defined goals for the management of five kinds of learning disciplines critical to long-term company survival, viz.: team learning, shared vision, mental models, personal mastery and systems thinking. Based on drivers of successful outcomes for other perspectives, objectives and measures underpinning continuous learning and growth were identified. Selected productivity measures in this area are as follows:

Learning & Growth Perspective	
Objective	**Measure**
Link overall strategy to the reward and recognition system	• Net revenue per dollar of variable pay
Foster a culture that supports innovation and growth	• Annual preparedness assessment reports
Develop those competencies critical to the overall critical gaps to be filled	• % competency deployment matrix fitted
Enhanced job skills	• Training, schooling, coaching
Process efficiency	• Time to implement new projects/services • Time to access patient data • Quality of patient data relative to competition • Five year trend in services growth • Number of multi-functional project teams • Time taken to resolve key issues
Innovative capabilities	• No. of new services introduced per year • New services/employee • Ratio of new ideas generated to new ideas implemented • Value of new ideas (money saved/earned) • New ideas/employee
Technological prowess	• IT literacy of staff • % of IT expense to total revenue • Ratio of R&D expense to administrative expense • No. of times corporate data accessed • Data access by customer request • Computer links to corporate database • Computers/IT literate employee

The fifth, financial, perspective serves as a measure of self-sustainability and the company's capacity to generate resources to enhance its range of services. This perspective reflects the concern that every action should be part of the cause and effect relationship that culminates in improving short- and long-term financial prospects. In the process of identifying goals and objectives, appropriate financial metrics were identified that link financial objectives to the overall strategy. This perspective retains an interest in short-term performance but at the same time clearly reveals those drivers leading to long-term financial and competitive performance. Selected productivity measures in this area are outlined below:

Financial Perspective	
Objective	**Measure**
Capture increasing share of industry growth	• Company growth
Commercialize a stream of profitable new value added services	• Percentage of revenue and profit from new services
Revenues	• Annual growth in sales & profit
Profitability	• Return on total capital employed
Prosperity	• Cash flows
Capturing increasing share of market	• Growth vs industry growth

CONCLUSIONS

Competitive advantage stems from a wide variety of factors including human resources, financial strength, access to technology and brand reputation. Any measurement system that focuses on a single sort of measure is partial. Using it to direct corporate effort is like trying to fly a plane using just the altimeter as a guide, when speed, fuel consumption and angle of flight also need to be considered.

Published financial information is historical: it reveals what has happened. Public financial measures often shed little light on the strengths and weaknesses that shape a company's prospects. Using such measures alone is like driving a car by looking in the rear view mirror. Moreover, financial measures are often only a snapshot: they do not account for the dynamics and processes at work inside a company over time. Measuring a car's speed merely tells us how fast it is going over a given distance and period. An account of the power of the engine driving it provides a far more revealing picture of the performance of which it is capable. Executives, investors and auditors all benefit from a measurement system that looks inside the engine of a company.

Companies are increasingly dependent upon networks of relationships with other organizations - product development partners, suppliers, distributors, franchisers. The quality of these relationships is often vital to a company's competitive position. Yet the performance and value of these relationships is excluded from an assessment of the company's worth unless there is a financial or equity-based relationship. Relationships such as these are one aspect of organizational capital: they are vital to competitive advantage and need to be accommodated within a new measurement system.

It may be safely concluded that, to gauge their true health and level of performance, the productivity of service organizations must be measured, evaluated and reported from various perspectives because of the complex webs of relationships that sustain them. No single one-size-fits-all productivity measure can give a true picture of performance or serve the purpose. In view of this, a benchmarking clearinghouse needs to be established in Asian countries that will provide comparative and comprehensive information about performance within the service sector and expand our horizons on the measures being employed.

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PRODUCTIVITY IMPROVEMENT IN THE SERVICE SECTOR: THE PHILIPPINES EXPERIENCE

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INTRODUCTION

This paper describes the productivity improvement efforts in the Government Service Insurance System (GSIS) in the Philippines, which is a government financial institution tasked with handling the social security benefits of all government employees. The GSIS commenced operations on May 31, 1937. Having evolved over time through legislation that expanded the scope of its operations, today's GSIS actually takes on the roles of:

- A social security institution responsible for providing government employees with social security and insurance protection against the contingencies of life and work, e.g. death, disability, sickness, unemployment, separation and retirement. The aim is to create peace of mind so that employees are empowered to do their best while serving government.
- The government's property insurance authority tasked with managing the government's various non-life insurance needs, seeing to it that public properties are sufficiently covered against all forms of risk, that government pays only the correct premiums and that it is properly and promptly compensated for losses. By doing this, the system helps ensure that public services are not interrupted or sacrificed in the event of damage to or destruction of public facilities and infrastructure on account of fire, accidents, casualties or calamities.
- A government financial institution serving as a catalyst for growth and development. It mobilizes vital capital resources for national development through investments geared to business and economic growth, the attainment of economic self-reliance, and the realization of long-term government plans. Thus, it helps stabilize financial markets, provides funds for small and medium enterprises, and makes available funds for long-term government programs via investment in government bonds and other securities. It provides loan windows to individual borrowers via the salary loan, emergency loan, policy loan, individual real estate loan and mass housing loan schemes. It also provides loans to institutional borrowers through its local government units lending program, industrial and commercial lending and special financing program for Small and Medium Enterprises.

Vision and Mission Statements

In September 1998, 35 executives crafted the GSIS Vision statement, an expression of its values, aspirations, ideals and philosophies. Hand-in-hand with this, they also drew up the Mission statement, which defines its basic character, the reason for its existence and the ends it aims to pursue. The GSIS Mission also provides the direction toward which all programs and key activities must ultimately converge.

The Vision is as follows:

"We envision a progressive Philippines whose public servants are secure and proud with our adequate benefits and responsive service."

The GSIS Mission reads:

"We are committed to provide adequate benefits and responsive services to all members and dependants, comprehensive protection to government insurable interests and the maximum contribution to nation building. We undertake all these in an environment where inspired leadership and dedicated employees promote the highest quality of services to our members and clients."

The GSIS Vision and Mission statements, together with the corporate values of *Excellence*, *Professionalism, Efficiency, Integrity* and *Customer Focus*, serve as the fundamental premises for the yearly corporate planning conference, which is aimed at determining the general direction and objectives of the GSIS and the policies, strategies and programs that have to be undertaken within a defined period to attain such objectives. The GSIS planning and control processes are undertaken throughout all levels of management.

The GSIS today services about 1.5 million government employees and 185,441 pensioners (old age, disability and survivorship). It has a total workforce of 2,722 in the main office and its 27 branches.

PRODUCTIVITY IMPROVEMENT EFFORTS

Following its first major reorganization in 1978, the GSIS adopted a number of productivity improvement programs that included:

- Decentralization of basic services, e.g. social insurance, the granting of loans and non-life insurance such as fire, vehicle and bonds;
- Time and motion studies;
- Reorganization;
- The Productivity Improvement Program/Work Measurement and Simplification;
- The Quality Circles Program;
- The Suggestion and Award System;
- Systems and procedures simplification and documentation;
- The Computerization Program;
- The Human Resources Development Program; and
- Installation of the GSIS Planing and Control System.

However, despite all these programs, productivity remained an elusive dream. Complaints about delayed transactions continued to be received and the labor union, which is a very strong force in the GSIS, regularly clamored for higher wages. Although a solid financial base is one of the GSIS's strengths, it was not fulfilling its potential in terms of being able to provide higher benefits to employees and other stakeholders. There was a need to adopt an integrated systems approach to productivity rather than the piecemeal implementation of separate programs.

In August 1998, the GSIS Planning and Control System was institutionalized to provide the framework for productivity improvement. Productivity thus served as the core of planning and control activities, as illustrated in Figures 1 and 2.

Figure 1. Productivity Improvement Framework

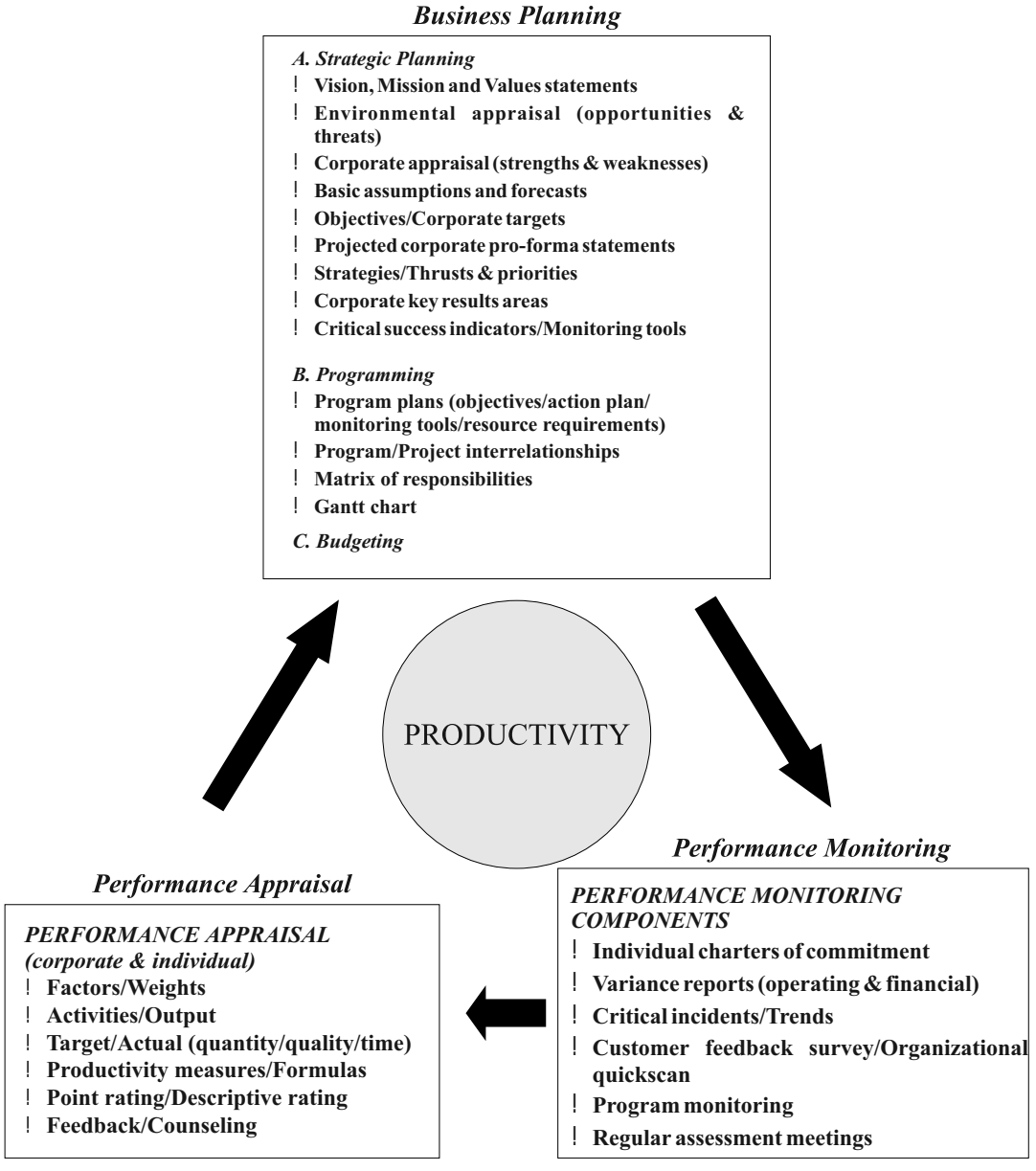
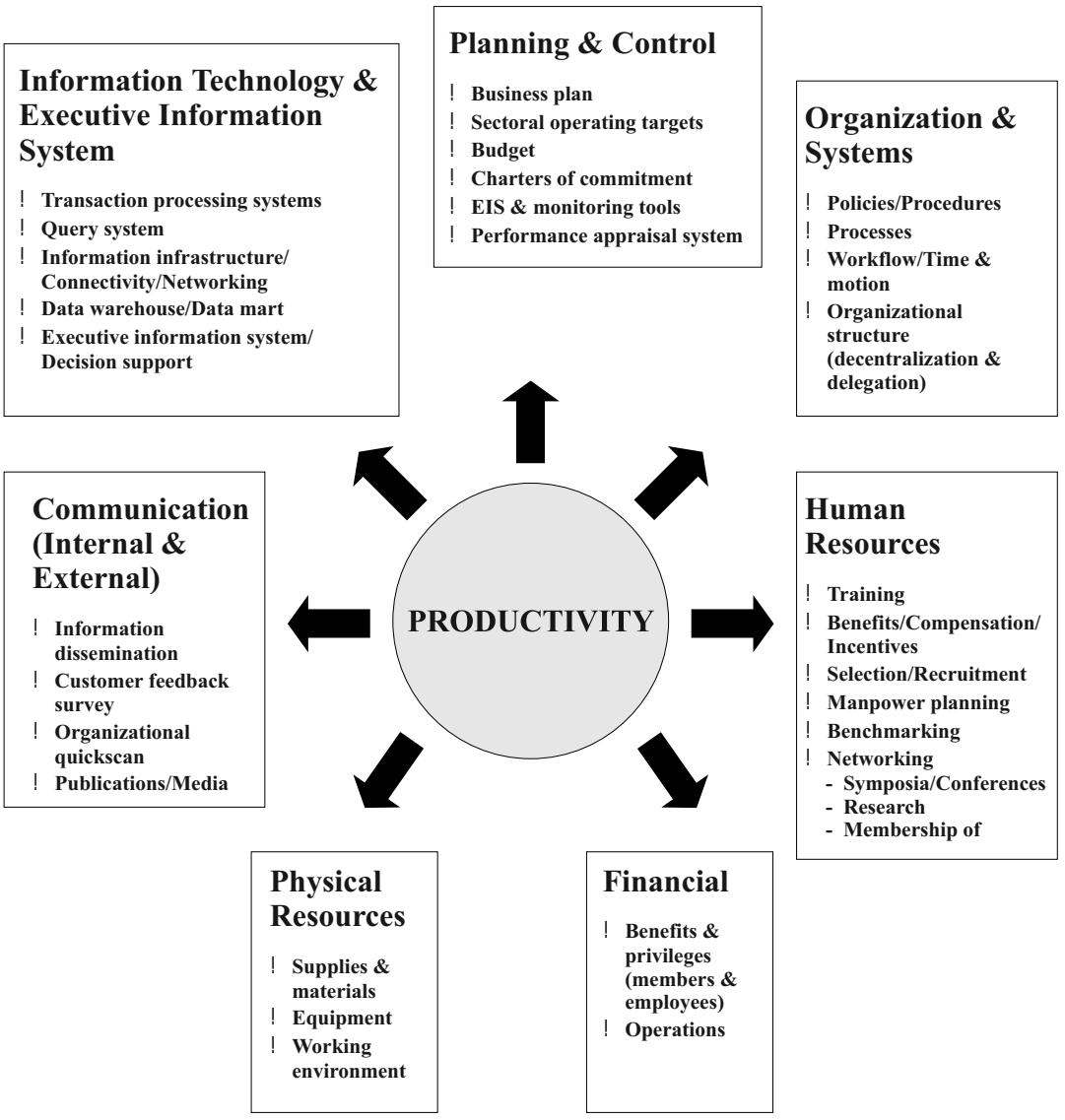


Figure 2. Integrated Systems Approach



Productivity Measures

As part of its Planning and Control System, the GSIS adopted a set of critical success indicators relating to processing and financial performance. These measure the extent to which it is attaining its objectives and provide tools for measuring performance in each of the corporate key result areas. They define the type of data to be gathered, the frequency of transmittal of these data to the different levels of management and the format in which the data or information should be made available.

The indicators are as follows:

Processing Performance

1. Average Processing Time (APT) reflects the actual time, in days, that a transaction takes, e.g. a loan is granted or a claim settled.

2. The Production Effectiveness Ratio (PER) measures the effectiveness of the operating unit in processing the total workload available.

$$PER = \frac{\text{No. of claims settled/Loans processed}}{\text{Total available claims/Loan applications}} \times 100$$

Financials

Overall Financial Performance

1. The Total Performance Index (TPI) tracks the effectiveness and efficiency with which the GSIS fulfills its mission of paying claims promptly and faithfully over a given period. It measures how many times claims payments (including increases in reserves) have been earned during the period being rated.

$$TPI = \frac{NI + (CL + \Delta R)}{CL + \Delta R}$$

where:

- NI = Net income, i.e. revenues less expenses (including claims payments, provision for increases in reserves, and taxes if any);
- CL = Claims payments; and
- D R = Provision for increases in reserves.

2. Return on net worth (RON) measures the net return on funds administered by the GSIS.

$$RON = \frac{\text{Net income during period}}{\text{Average reserve \& surplus during period}}$$

3. Return on Total Assets (ROTA) measures the net return on the total assets of the GSIS.

$$ROTA = \frac{\text{Net income during period}}{\text{Average reserve (admitted \& non-admitted) during period}}$$

Collections

1. The Collection Performance Ratio (CPR) measures the effectiveness of GSIS collection activities during the period covered. This indicator has application in measuring effectiveness in collecting premiums, contributions, investment income, repayments on loans, as well as liquidated investments and other collectibles.

$$CPR = \frac{\text{Actual collections during period}}{\text{Total arrears collectible at start of period + Estimated collectibles due for period}}$$

2. Average Collection Period (ACP) measures the average number of days it takes GSIS to collect its receivables. If ACP is compared with the average grace period of the GSIS, the variance provides an estimate of the average length of time for which accounts are past due. This indicator is applicable for all types of collectibles.

$$ACP = \frac{\text{Total collectibles}}{\text{Average collections per day}}$$

$$\text{where: Average collections per day} = \frac{\text{Annual collections}}{365}$$

Profitability and Soundness of Investments

1. Return on Admitted Assets (ROA) measures the profitability of the investments of the GSIS relative to its admitted assets. This indicator is very significant, especially when compared to the actuarial yield rate.

$$ROA = \frac{\text{Net investment income for current year}}{\text{Mean admitted assets}}$$

$$\text{where: Mean admitted assets} = \frac{A + B - I}{2}$$

and:

- A = Admitted assets, beginning of the year;
- B = Admitted assets, end of the year; and
- I = Net investment income.

2. Return on Investment (ROI) measures the profitability of the investments made by GSIS. This indicator may be applied for each type of investment to determine the most profitable areas of investment.

$$ROI = \frac{\text{Investment income}}{\text{Average total investments (ATI)}}$$

$$\text{where: ATI} = \frac{\text{Investments, beginning + Investments, end}}{2}$$

3. Portfolio-Type Investments to Total Investments (PT/TI) indicates the proportion of portfolio-type investments to total investments. This ratio should be compared from one period to another to determine progress in the reorientation of loans and investments.

$$PT/TI = \frac{\text{Total portfolio-type investments}}{\text{Total investments}}$$

4. The Investment Utilization Ratio (IUR) provides a measure of efficiency in investing funds available for the purpose. This ratio has a direct bearing on the return on admitted assets and should therefore be maximized.

$$IUR = \frac{\text{Total investments made during period}}{\text{Total investible funds for period}}$$

Liquidity and Solvency of Funds

1. The Current Ratio (CR) measures the ability of the GSIS to meet its short-term obligations. This ratio should be compared from one period to another to measure the changes in the liquidity position of the organization.

$$CR = \frac{\text{Current assets}}{\text{Current liabilities}}$$

2. The Solvency Ratio (SR) indicates the ability of the GSIS to meet its long-term obligations. The ratio may be applied for individual funds or for the aggregate fund.

$$SR = \frac{\text{Actual reserves}}{\text{Actuarial reserves}}$$

where:

- Actuarial reserves = Reserves as determined by actuarial valuation; and
- Actual reserves = Admitted assets - Current liabilities.

Asset Structure

1. The Operating Assets Ratio (OAR) measures the efficiency of the GSIS in utilizing its assets. The higher the ratio, the more efficient is the management of assets.

$$OAR = \frac{\text{Operating assets as of end of period}}{\text{Total assets as of end of period}}$$

where: Operating assets refer to those assets, whether earning or not, which are used by the System for operation or for investments. In other words, operating assets are assets that are not idle.

2. The Earning Assets Ratio (EAR) provides a gauge as to what percentage of the total assets is earning. The capability of GSIS to improve its ROA is largely influenced by the EAR.

$$EAR = \frac{\text{Total amount of earning assets}}{\text{Total assets}}$$

3. The Loans and Investments to Total Assets Ratio (LI/TA) is a measure of the proportion of assets that are loaned and invested.

$$LI/TA = \frac{\text{Total loans and investments}}{\text{Total assets}}$$

4. The Admitted Assets to Total Assets Ratio (AA/TA) provides a gauge of what proportion of total assets are admissible, from the viewpoint of the Insurance Commissioner, as a guarantee to sustain the payment of future benefits.

$$AA/TA = \frac{\text{Total admitted assets at end of period}}{\text{Total assets at end of period (admitted \& non-admitted)}}$$

Benefits, Premiums, and Costs

1. The Insurance Benefits to Premium-Contributions Ratio (IB/PC) measures the sufficiency of premiums/contributions collected to sustain the payment of claims during the period under review.

$$IB/PC = \frac{\text{Insurance benefits paid during period}}{\text{Total premiums and/or contributions collected during period}}$$

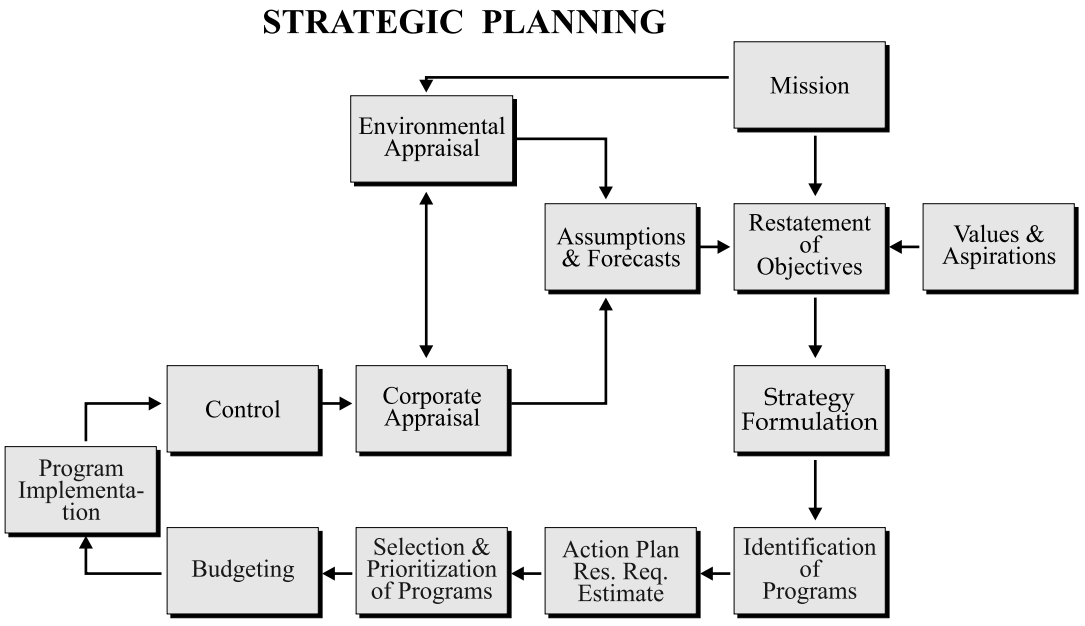
2. The Administrative Expenses to Premium Contributions Ratio (AE/PC) measures the proportion of premiums/contributions spent on administrative expenses. This ratio is useful in controlling costs within budgeted levels. It is also used in modifying the expense loading assumption in the computation of premiums and contributions.

$$AE/PC = \frac{\text{Administrative expenses for period}}{\text{Total premiums and/or contributions for period}}$$

3. $$\text{Expense Loading} = \frac{\text{Administrative and operating expenses}}{\text{Total revenues}}$$

The GSIS planning and control cycle is illustrated in Figure 3.

Figure 3. The GSIS Planning and Control Cycle



During the yearly corporate planning activities, operating and financial targets are set based on certain assumptions and forecasts formulated from the results of the regular environmental and corporate appraisal. These targets relate to the critical success indicators and, once agreed upon, become the basis for the development of thrusts and priority programs for the period. The time-phased human and material resource requirements of the different programs are costed. The revenue and cost implications of the different programs are then translated into responsibility accounting center budgets. The financial impact of the programs and targets is evaluated by expressing the projected revenues and expenses in pro-forma cash flow statements, income statements and balance sheets. The pro-forma statements are projected over the plan period and an analysis is undertaken to determine whether or not the programs are consistent with the long-range objectives of the GSIS.

The targets, program plans and pro-forma statements, together with the other planning premises and the monitoring tools, make up the GSIS Business Plan for the period. This serves as the basis for the sectoral operating targets, the budget and the charters of commitment that are cascaded down the line for monitoring purposes and for the performance appraisal conducted twice yearly.

The GSIS makes use of four types of reporting mechanisms in evaluating its performance vis-à-vis its objectives, namely:

1. *The Corporate Feedback Survey.* This is a mechanism for measuring performance from the viewpoints of both internal and external clients. It has two components, the Customer Feedback Survey, using members and clients as respondents, and the Organization Feedback Survey, using executives and employees as respondents. These surveys are conducted annually by the Corporate Planning Services Department, using a simplified questionnaire of the multiple-choice type as a survey instrument. Raw data from the survey are edited, coded and fed into the computer for processing. Qualitative responses and other suggestions of members are grouped and tabulated for analysis as possible areas for improvement. The analyzed responses of all the respondents are then utilized as input for the planning exercises conducted yearly.

2. *Program Monitoring.* This enables the GSIS to keep track of progress in the implementation of the different programs. It monitors program activities to identify significant deviations from the action plan so as to formulate corrective actions. The key activities of the different programs are broken down into departmental responsibilities, which serve as a guide for the different sections, divisions and departments in preparing their work programs on a monthly basis.

3. *Financial Reporting.* The aim of this is to measure financial performance. It has two components, namely Financial Statements and Budget Reports.

    - Financial Statements - The financial results of operations and the financial position of the GSIS as of a given time are determined from the monthly consolidated financial statements prepared by the General Accounts Department. The consolidated income statement summarizes the revenues/collections generated and the expenditures incurred during the period under review. The impact of these on the financial position of the GSIS is shown on the consolidated balance sheet. These financial statements provide the data to which the financial indicators will be applied.
    - Budget Reports - The actual costs incurred and revenues generated for each month are summarized by program and by responsibility accounting center. These costs and revenues are compared against the budgeted figures to arrive at variances. The budget reports are prepared and consolidated by the Budget and Control Department for distribution to all the responsibility accounting centers. Significant variances are analyzed by the managers and used as a guide in undertaking the necessary corrective measures.

4. *Production Reporting.* This reporting mechanism summarizes and transmits production data from production units to the different levels of management. The analytical tools used to measure the critical success indicators are applied to production data to determine the performance of the different units and the GSIS in general. Data on production and processing time or actual results are compared against the planned target levels. Trends and significant deviations are analyzed and fed forward to alert managers regarding the likely impact of past performance on future performance so that corrective actions may be undertaken.

The Control Subsystem regulates the implementation of the action plans and the information gathered from the control exercise becomes an input to the Strategic Planning Subsystem. The process thus loops back into the Strategic Planning Subsystem to complete the planning and control cycle.

TRENDS, ISSUES AND PERFORMANCE

The GSIS has made important leaps in its performance in terms of the various critical success indicators. Over the 3-year period from 1997 to 1999, the processing time for the granting of loans was reduced from 30 working days to 2 working days and for retirement claims from 15 working days to 5 working days. The Processing Effectiveness Ratio (PER) for retirement claims processing increased from 74 percent to 87 percent. Total assets rose from P120.084 billion to P162.729 billion. Total revenues rose from P31.328 billion to P51.051 billion. Administrative and operating expenditures as a percentage of total revenues (Expense Loading) was reduced from 7.90 percent to 6.71 percent.

As a result of its good financial performance, the GSIS has been able to increase its social security benefits. Old age, disability and survivorship pensions have increased by 12 percent alongside increased retirement benefits, with an increase in the average monthly compensation limit from P9,000 to P11,000. The GSIS Salary Loan Program has likewise been expanded, with a rise in the maximum loan from 3 months' salary to 5 months' and even 8 months' salary to date.

FUTURE DIRECTIONS

The GSIS believes that information technology is central in achieving operating efficiency and effectiveness. Consistent with this view, it plans to take steps to establish a computerized environment, which will have significant impact on improving service delivery and transactional processing in all facets of operations. The following strategic thrusts will be the primary concern of the GSIS for the next five years, as contained in its Business Plan for the years 2000 to 2004:

1. Computerization

   Objective: To automate those processes that will ensure speed and accuracy of response and efficient delivery of services.

2. A Comprehensive Organization Review

   Objective: To design a dynamic, responsive and cost-effective organization that is supportive of the Corporate Vision, Mission and objectives.

3. A Customer-Focused and Performance-Based Culture

   Objective: To achieve maximum efficiency and effectiveness in customer service, in a quality-driven, customer-focused culture and in an atmosphere of consistent behavioral norms.

4. Strategic Human Resource Management

   Objective: To ensure that the organization has the right number and quality of people in the right places at the right time, performing the right functions in their pursuit of organizational objectives.

5. Strategic Financial Management

   Objective: To manage GSIS funds in such a manner as to maintain a sufficient level of liquidity and ensure actuarial solvency at all times, and ultimately to provide adequate and responsive benefits to members and their dependants.

6. Comprehensive Asset and Physical Resource Management

Objectives:

- To maximize the utilization of physical assets and resources; and
- To provide the most suitable tools and equipment, adequate supplies and materials and a total physical environment conducive to the effective and efficient accomplishment of objectives.

THOUGHTS TO PONDER UPON

"A good manager controls the plan, a bad manager controls people."

"To produce more, we have to see further down the road - to long-term quality and savings."

"Only as we get that big picture will we cope with tomorrow's challenges and harness its opportunities."

"We may have the most elegant formulas and the most sophisticated tools to measure productivity. However, all these will be naught if we do not have the blueprint to effect increased outputs and better quality of service; for in the end, we shall only be measured by our results."

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INTRODUCTION

Rather than the amorphous notion of 'competitiveness', the key to a high standard of living is the productivity with which a nation's resources (labor and capital) are employed. This was first expressed by Michael E. Porter in 1990 and reiterated by Nagao Yoshida, the Secretary-General of the Asian Productivity Organization, in 1991. He observed that "… productivity is the single most important factor and determinant for the survival of business, the prosperity of nations and the standards of living of the people" (Bernolak, 1991). Productivity improvement is the primary means to economic growth because the scarcity of resources makes economic growth driven purely by increasing inputs unsustainable (Krugman, 1994).

Productivity improvement begins with an understanding of the nature of productivity. This is commonly defined as "… the efficiency and effectiveness with which resources - personnel, machines, materials, facilities, capital, time - are utilized to produce a valuable output" (Ranftl, 1978). In simple terms, it is the ratio of output to input.

Productivity in the Service Sector

In developed countries, the service sector - international trade, trade logistics, business and professional services, tourism, and media and communication - is becoming an increasingly important component of the economy. Even in developing countries where manufacturing forms the pillar of the economy, services have gradually become the focus. In Singapore, the value of service exports in 1996 was $47 billion, accounting for 54 percent of non-oil domestic exports (*Business Times,* 28 July 1997).

The main objective of this paper is to present a framework for process-based productivity measurement for the service sector. This framework is operationalized through the development of process-based productivity measures for four high-performing logistics companies. With the drive to be a regional hub, the Singapore logistics industry is poised to become a key industry. However, it will have to improve its competitiveness by seeking more external resources and increasing the productivity of its operations. The paper first highlights the existing productivity management in these companies and shows how the process-based productivity of logistics activities can be measured. It then compares current measures with these process-based productivity measures.

SERVICE PRODUCTIVITY: TRENDS, ISSUES, AND PERFORMANCE

Overview

In both the manufacturing and service sectors, productivity improvement can only take place if productivity is managed properly. Proper management includes productivity measurement, identification of unproductive areas, development and implementation of productivity improvement policies and evaluation of these efforts. Of these, useful and accurate productivity measures are the most critical. Such measures can indicate a firm's current productivity, as well as its performance relative to competitors, and offer insights into its performance.

Branche and Rummler (1990) highlighted the fact that performance must first be measured because measurement is the pivotal performance management and improvement tool. In a study of the productivity of a physical distribution industry, Clarke (1991) showed that a good productivity measurement system helps to:

- Highlight inefficient areas of production to focus managerial attention;
- Track valid productivity changes over time that can determine progress toward goals;
- Improve managers' insights into relevant processes;
- Provide an objective basis for comparison with similar operations within a given industry;
- Compare productivity across individuals, units, organizations and the industry in order to assist with management decisions;
- Link management and labor in productivity improvement efforts to build common awareness and responsibility;
- Demonstrate productivity gains to interested stakeholders; and
- Support incentive and bonus plans with objective productivity data.

In spite of the importance of measuring productivity, managers often do not do it for various reasons:

- Productivity is seldom seen as the main determinant of financial success.
- Since many factors influence productivity, it is difficult to integrate them meaningfully into a few measures.
- The relationship between physical output and physical input, which defines productivity, is often ignored.
- A number of misconceptions about productivity still exist - for example, it is often equated with production, and thus productivity increases when production increases. Productivity is also seen as just plant efficiency and therefore the responsibility of the shopfloor personnel.
- Productivity is seen as depending solely on technology.

Practices in the Service Industry

A study of quality management practices in Singapore (Chong, 2000) showed that, in most service companies, informal approaches to measuring productivity were often used. Some controls were used to monitor productivity but these were not stated in the specific form of productivity measures as they served to guide managers on work assignment, taking corrective action and keeping track of the overall performance of the department. In many cases, these controls were not comprehensive, were generally independent of each other, or focused only on activities seen as critical. For example, the productivity of sub-processes or activities involving labor was usually monitored because it was critical for efficient and effective service. Little attempt was made to examine the relationship between individual measures and the overall process. This is best illustrated by the following finding:

> *"All delivery teams are expected to make at least one delivery run a day. Each delivery run could involve about 30 customers. Based on previous experiences, the management knows that each team can make at most two delivery runs. Therefore, the delivery team will be considered productive if it can make two runs daily. By so doing, the company will be providing better service by reducing their customers' lead-time. In order to encourage its delivery team to be more productive, the firm has an incentive scheme in which the team gets an additional $100 over and above the usual payment for making a second delivery run."*

Generally, assessment of productivity was solely based on the manager's past experience or observations of what constitutes high productivity. The monitoring cost was low as no specially assigned personnel or system were needed to keep track of the data. This approach was also deemed acceptable as it implied that management knew how tasks were performed. The inherent weakness was that standards were not articulated or formalized. This raised doubts about their validity, especially when performance conditions changed over time. Often, productivity and performance measurement were not differentiated. Rather, they were viewed similarly, although more attention was given to performance measurement.

> *"There are attempts to track the productivity of some activities but also the performance (productivity) of the workflow in the section. The existing measurement system does not utilize what is called direct productivity measures (output/input). Instead, it infers the productivity of the process/sub-processes concerned from the indirect measures. Indirect measures include dock to stock time, daily completed orders, downtime of critical resources, cargo rejection and overtime versus work volume. Although manpower is critical to the operations of the section, there is no formal monitoring of labor productivity. Labor productivity is monitored by exception through the observations and past experiences of the leaders and assistant leaders of the departments."*

Many of these companies also viewed the complexity of their operations and the dynamic nature of the business as obstacles to the development of a comprehensive productivity measurement system. This was aggravated by the shortage of manpower. As most service activities were labor intensive, companies had to cross-train workers to enhance their utilization. Little manpower could be spared to maintain any productivity measurement system that might be implemented.

> *"The informal productivity measures are developed based on the management's past experience with the tasks. The measures formulated are meant to be easy to use and understand. Therefore, the measures are simple and mainly measure labor productivity. For example, a productivity measure like number of tons handled daily per employee gives the company an idea of its overall productivity level. In addition, the management exercises some degree of flexibility when tracking productivity. This is because the company recognizes the need to allow for human variation and that the measures may not be perfectly accurate.*
>
> *The management also knows that the productivity of operations is not just a result of the efforts of the operations personnel but also dependent on the performance of other departments. Thus, the company will not penalize the department concerned if low productivity is due to poor performance by a related department. For example, although the warehouse personnel are expected to handle 600 pallets daily, it is not penalized for its current productivity of 300 pallets daily. This is because the warehouse personnel cannot be responsible for the inability of sales and marketing to obtain sufficient sales orders. This is therefore a systems approach to management."*

Finally, there were also concerns about the tangible and intangible costs of developing and using any new productivity measurement system. These could arise from redesigning work tasks, which would necessitate new co-ordination measures and incur training costs, and from modification to ensure the appropriateness of the system.

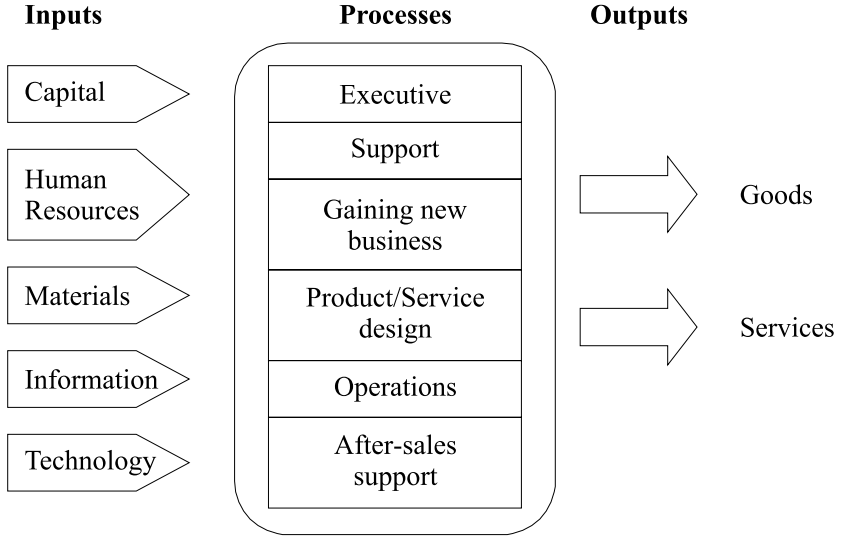
"The management of Worldwide Logistics Singapore recognizes that productivity improvement can lead to significant increments in its bottom line. As a result, the company is very concerned about the productivity of its operations. There is however no formal productivity measurement in place at the company. The management feels that a formal productivity measurement system is not suitable for the company because the cost of collecting the data may offset the benefit it can gain from tracking company productivity. In addition, an informal productivity measurement system is more appropriate for the rapidly moving environment which it operates in."

PRODUCTIVITY MEASUREMENT SYSTEM

Systems/Process View

The systems view posits that any system is made up of inputs, processes and outputs. This is graphically represented in Figure 1.

Figure 1. A Systems/Process View (modified from Ostrenga et al, 1992)



Each process is made up of a series of repetitive and interrelated activities with prescribed inputs and outputs. There are three ways this systems view differs from the traditional view of management. First, it includes three important elements - the customer, the product, and the flow of work. By taking into consideration these elements, it enables better productivity measures to be developed. Second, it shows how work is carried out. This facilitates the development of relevant, informative productivity measures. Finally, it shows the relationships between the internal customer and supplier through whom products and services are produced. This enables individual departments to see how their productivity affects overall organizational productivity.

As the systems view gives the company clearer insights into its effectiveness in satisfying customer needs and accomplishing its work, it forms the foundation for Total Cost Management and Activity Based Management. However, this view also has its limitations. First, the concern for the totality of a system may not be translated into meaningful specifics for problem analysis. Second, there is the problem of determining the precise effects because of interdependencies, and, finally, the systems approach may underestimate the importance of people in the system.

Process-Based Productivity

Various attempts have been made to measure and view performance using the process/systems approach. The same cannot be said for productivity, even though traditional productivity measurements are not very useful for pinpointing the performance of individual processes. The old measure of output/input is not concerned with the establishment of the customer-supplier supply chain, value-adding activity and the incremental contributions of each process. As early as 1977, Ross had already proposed that a process-oriented approach be used to manage productivity. Christopher (1993) suggested applying the process approach to measure and improve white-collar productivity. A productivity/quality process map was developed to enable him to define the performance measures appropriate to a process and its sub-processes. The process approach can also be applied to processes within departments. Christopher (1993) demonstrated how this could be done in the sales and marketing department.

Fitzgerald (1997) proposed that newspapers refocus their attention from looking at productivity in isolated departments to examining it over the entire manufacturing process. He argued that traditional productivity measurement matrices for newspapers should be replaced with models that measured productivity throughout the entire range of manufacturing and distribution. He further illustrated how productivity improvement in one department caused a decline in the productivity of a downstream department - a case of sub-optimization. Biema and Greenwald (1997) emphasized that, in order to increase service sector productivity, managers need to identify the distinct activities performed in their companies and deal with each in an appropriately tailored way.

Despite these positive views, there has been little research on process-based productivity. Some of the issues that need to be explored further are:

- Developing simple and feasible measures for use by practitioners;
- Making the link between individual measures and the overall process measures; and
- Applying the process approach to productivity measurement in practice.

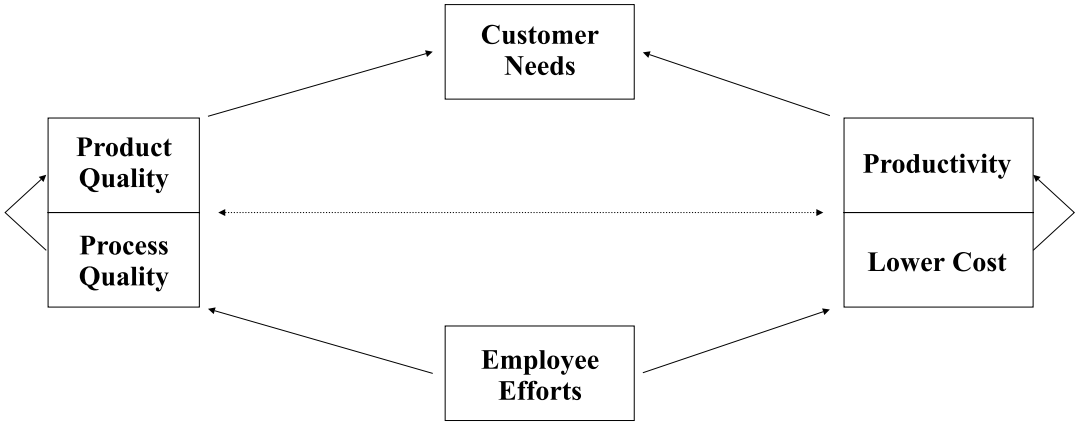
Productivity and Quality

Quality is the total composite product and service characteristics of marketing, engineering, manufacturing and maintenance through which products and services in use will meet the expectations of the customer (Feigenbaum, 1983). In simpler terms, quality is fitness for use (Juran, 1989).

The traditional input-output measures of efficiency have led to a linear interpretation of productivity and therefore to productivity being linked only to efficiency (Koss & Lewis, 1993). However, productivity depends on both efficiency and effectiveness (Cook et. al, 1997). Since effectiveness is about doing things right, productivity should show if any or all of the following results can be achieved: timeliness, quality, quantity and cost (Zairi, 1994).

The quality of goods and services is directly linked to productivity because of the basic truth that "defects are not free" (Deming, 1981). Raghuraman (1994) used the diagram in Figure 2 to show the convergence between organizational productivity and organizational process-quality improvement, since both are aimed at the customer by providing better products and services. Quality concentrates on the interface between customer needs and the product/service quality offered, whereas productivity focuses on lower cost, thus satisfying another important customer need.

Figure 2. Organizational Productivity and Process-Quality Improvement



MEASUREMENT IN SPECIFIC INDUSTRIES

The Supply Chain and Logistics

The supply chain has several characteristics (Houlihan, 1985):

- It identifies the complete process of providing goods and services to the final user;
- It includes all parties and logistics operations from supplier to customer within a single system;
- Its scope includes procurement, production and distribution;
- It extends across organizational boundaries;
- It is co-ordinated through an information system accessible to all members;
- It must balance service to customers against costs and assets; and
- The objectives of individual supply chain members are achieved through the performance of the chain as a whole.

Logistics is defined by the Council of Logistics Management as "the process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in process inventory, finished goods and related information from the point of origin to point of consumption for the purpose of conforming to customer requirements." Logistics is therefore closely related to the supply chain because of the activities it performs.

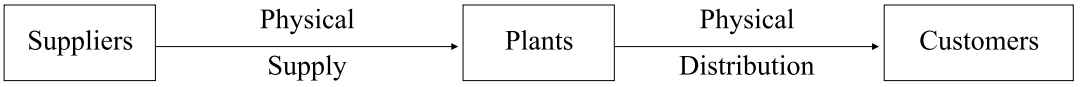
Competition to supply global markets forces a close link between distribution and the supply chain (Schary and Skjott-Larsen, 1995). Rose (1979) observed that the management of the movement of goods has always been fragmented and divided between functional departments. This has resulted in sub-optimization and even loss of profits and efficiency for the firm despite gains by some of its units.

Some aspects of the logistics concept have helped to overcome the weaknesses of traditional logistics management. For example, a systems approach is used to co-ordinate the management of the physical movement of goods and informational flows and related activities. Logistics is also designed to meet customer and firm needs in an efficient and effective manner since it is recognized as a service function.

Thus, logistics is a collection of functional activities that are repeated many times throughout the channel through which raw materials are converted into finished products (Ballou, 1992). With the increasing importance of logistics, firms that specialize in logistics services and known as 'third party logistics providers' have evolved.

The role of logistics can be divided into two parts - physical supply (materials management) and physical distribution. The physical supply channel refers to the time and space gap between a firm's immediate material sources and its processing points. Similarly, physical distribution represents the time and space gap between the firm's processing points and its customers.

Figure 3. Logistics for Individual Firms (reproduced and modified from Ballou, 1992)



Basically, logistics activities are classified into key and support activities. Key activities are customer service standards, transportation, inventory management and order processing. Customer service standards set the level of output and the degree of readiness to which the logistics systems must respond. Transportation is necessary to move raw materials and finished products, while inventory management is needed to ensure product availability and production flexibility concurrently. Finally, order processing triggers product movement and service delivery. These activities take place in every logistics system. They either contribute most to the total cost of logistics or are essential to the effective co-ordination and completion of the logistics task.

Support activities are not always present, although some of them may be as important as key activities for certain logistics systems. Such activities include warehousing, materials handling, purchasing, and protective packaging, all of which function co-operatively with production and information maintenance.

Productivity Measurement Concerns

In productivity measurement, there are a number of concerns and guidelines. One important concern is the validity of the measure. In the context of productivity measurement, validity is defined as the relationship between what is measured and what the person doing the measurement wants to know. Careful and thorough consideration of what it is that we want to know is needed to produce valid measures (Brinkerhoff & Dessler, 1990).

Another concern is reliability. Productivity measures must be reliable or accurate. Reliability is a characteristic of the measuring tool and the manner in which it is implemented. It relates to how well the measure consistently measures the same phenomenon of concern (Brinkerhoff & Dessler, 1990).

Reactivity is the tendency of a measuring process to influence what it measures. This means that data collected solely for productivity measurement may be given greater attention. This concern can be alleviated by using available data where possible (Brinkerhoff & Dessler, 1990).

To address these concerns, some guidelines for productivity measurement need to be followed. Measures need to be:

- Complete so that productivity can be adequately assessed;
- Incisive so as to reflect variables unique to the activity/sub-process/process;
- Comparable over time for the same activity/sub-process/process;
- Understandable to those who are using them;
- Acceptable to those who are being measured;
- Developed together with those performing the tasks; and
- Cost effective.

In addition, measures should be kept simple when used initially. Employees should also see the link between their performance and the productivity measure that is in use.

METHODOLOGY OF SELECTION, USE AND PRESENTATION OF PARAMETERS

Framework for Developing Process-Based Productivity Measures

In process-based productivity measurement, the focus is on the process, sub-processes and activities. To reiterate, a process is made up of a series of interrelated sub-processes. In turn, each sub-process is formed by various sequential activities. The boundaries of the process, sub-processes and activities are not fixed, but depend on how they are determined within the context of the defined objectives of the process. This concept and the associated measurement methodology are illustrated below with examples taken from a study involving four companies in the logistics sector.

Measures were developed for a number of sub-processes. The objectives of each sub-process were first identified so as to ensure valid measures that would reflect what each sub-process should accomplish. The important activities within the sub-process were then identified. From these, the focus was on constructing measures based on the activities that had an impact on the productivity of the sub-process or activity series. An input-output list was drawn up for each measure and the critical input(s) and output(s) were identified. As far as possible, data for the critical input(s) and output(s) should be obtained from existing data. The development of the measures and determination of the data to be collected are done concurrently.

In the study, various issues had to be overcome:

a) *Conceptualizing input-output measures:* Measures for administrative activities/sub-processes were difficult to develop and the data hard to collect. As each administrative employee performed more than one task concurrently, it was impractical to determine the inputs for each task. This made the productivity measures difficult to define. The productivity of some activities cannot be determined using the basic input-output concept; for example, how can we determine the productivity of planning the routes for delivery teams?

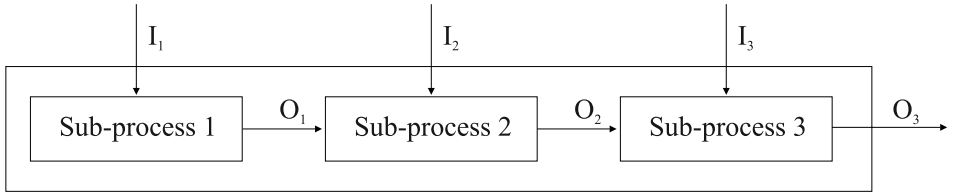
   Another problem encountered was the number of different products handled by each company. These products differed in weight, volume, size and ease of handling. With products as the output data, a common unit of measurement needs to be determined. Some input(s) and output(s) may not be under the control of the people whose productivity is being assessed. For example, the total sub-process time for retrieving goods from the port includes travelling time, which is affected by road conditions. This was overcome by using an average travelling time and tracking only the physical loading of goods and document processing time.

b) *Identifying the activities:* There are times when activities are not performed according to the prescribed sequence. For example, the physical goods flow may occur concurrently with the administrative workflow. Thus, if time is used as the input, the productivity measure is unreliable. This is aggravated when workers help each other out, and makes it very difficult to determine the input and output that should be attributed to each task.

   Another problem arises from the presence of external parties in the operational process, as some activities are outsourced to third parties. As a result, some of the productivity data need to be collected from these parties. Finally, data collection is also hampered when employees forget or have no time to note down the data. This affects data quality.

Basis of Process-Based Productivity

In this section, a basis for process-based productivity and three new productivity measures (Sequential Productivity, Sequential Contribution and Isolated Productivity) are developed to operationalize the relationships between sub-processes in a system. From a simple input-output view, interrelatedness is represented as follows:



Process A

Sub-processes are related sequentially and collectively and usually put into a black box, Process A. The systems view enables sub-processes to be seen as individual systems and in terms of how they are linked to the overall process. This is not possible with the traditional view, where productivity is simply the quantity of outputs generated by the inputs. In logistics, the inputs are the equipment and people and the outputs are goods handled. Therefore, the productivity of Sub-processes 1, 2, 3 and Process A is as follows:

$$\mathbf{P_1 = O_1 / I_1} \qquad \text{- (1)}$$

$$\mathbf{P_2 = O_2 / I_2} \qquad \text{- (2)}$$

$$\mathbf{P_3 = O_3 / I_3} \qquad \text{- (3)}$$

$$\mathbf{P_A = O_3 / (I_1 + I_2 + I_3)} \qquad \text{- (4)}$$

The productivity of Process A is stated in this way because the total inputs that go into the process are $I_1 + I_2 + I_3$. The intermediate products between sub-processes are not part of the inputs, but rather form part of the final product, O_3. The interrelatedness between sub-systems is represented by O_1, the output for Sub-process 1 that becomes the input for Sub-process 2. This relationship is similar for Sub-process 3. Through a mathematical analysis of equations 1, 2, 3 and 4, an equation is derived that shows how the productivity of individual sub-systems is related to the productivity of the overall system:

$$\mathbf{P_A = P_3 - P_3 * [I_1 / (I_1 + I_2 + I_3)] - P_3 * [I_2 / (I_1 + I_2 + I_3)]} \qquad \text{- (5)}$$

This equation implies that the productivity of a process cannot be greater than the productivity of the last sub-process in the sequence. This pattern is seen in a two-sub-process system, P_B and a four-sub-process system, P_C:

$$\mathbf{P_B = P_2 - P_2 * [I_1 / (I_1 + I_2)]} \qquad \text{- (6)}$$

$$\mathbf{P_C = P_4 - P_4 * [I_1 / (I_1 + I_2 + I_3 + I_4)] - P_4 * [I_2 / (I_1 + I_2 + I_3 + I_4)] - P_4 * [I_3 / (I_1 + I_2 + I_3 + I_4)]} \qquad \text{- (7)}$$

P_A, P_B and P_C are called Sequential Productivity. (P_A-P_B) and (P_C-P_A) are the Sequential Contributions. This is the effect on the original productivity when a sequential sub-process is added to the initial process. For example, when Sub-process 3 is added sequentially to a process containing only Sub-processes 1 and 2, the difference in Sequential Productivity (P_A-P_B) is the contribution of Sub-process 3 to overall process productivity. P_1, P_2 and P_3 are the Isolated Productivity of each sub-process under the functional view. These productivity equations underlie process-based productivity measurement. An important point to note is that the inputs and outputs should have the same units. From the systems approach, the Sequential Productivity and Contribution are more important and useful to productivity management than Isolated Productivity.

Development of Productivity Measures

This section shows how productivity measures could be developed for the four different logistics companies. The productivity measure for a chosen sub-process in each operational process is described, together with an explanation of how the input and output data are collected.

CASE A

Three sequential sub-processes were identified for process-based productivity measurement. They were 'Receiving Goods', 'Order Picking' and 'Pre-delivery Administration'.

Receiving Goods

It is important to note that only the productivity of receiving normal goods was measured. The first productivity measure for the 'Receiving Goods' sub-process is the number of pallets unloaded per man-hour. However, the number of pallets used depends on the size of the goods. While the surface of the pallet is always fully utilized, the height at which the goods are stacked varies. For this reason, a pallet equivalent unit is used as the standardized unit of measurement for the outputs. This is derived as follows:

As storage racks are divided equally into three or four levels, the two maximum heights depend on the rack configuration. The maximum height for each pallet is then approximated by computing a ratio of the number of the same type of storage racks to the total number of storage racks. There are a total of 28 racks, of which four are made up of three levels. Each of the four racks has a height of 2m for each level; the rest of the racks have a height of 1.6m per level. A weighted average maximum height ($4/28*2 + 24/28*1.6 = 1.66$m) is then used to determine the pallet equivalent units. For example, a pallet stacked approximately 1m high will be considered 1/1.66 or 0.62 pallet equivalent units. The manning level and unloading time are noted for each delivery and then multiplied together to arrive at the number of man-hours. A second measure for this sub-process is the number of pallets put on the racks per man-hour. These activities take place after all the checking has been completed. As in the case of the first measure, the pallet needs to be converted into pallet equivalent units.

Order Picking

The 'Order Picking' sub-process follows the 'Receiving Goods' sub-process as it was assumed that the activities of the preceding sub-processes did not have a significant impact on the productivity of this sub-process. This is reasonable because the orders brought back by the sales department are for next-day delivery, and once the orders are approved by the computer system, the invoices, picking lists and labels are immediately generated for order picking administration.

The important activity here is the order picking. The checking activities are less critical and are assumed not to seriously affect the productivity of this sub-process. In addition, it is also very difficult to collect data and develop measures on the productivity of checking. The measure used is the number of trolleys picked per man-hour. Due to the variety of product sizes, most of the trolleys are not fully filled. In addition, the item size and number of items in each trolley also determine the efficiency of the order picking task. Therefore, for each trolley of goods picked, the capacity of the trolley and the ease of picking the items are estimated to arrive at an equivalent trolley unit. The time taken for each order picker (number of man-hours) for each run is noted.

Pre-delivery Administration

The productivity of this sub-process is generally not affected by warehouse administrative activities, although at times some invoices may need to be signed by people in the sales department. The deliverymen then have to wait and this affects their productivity. However, this is rare.

The measure for this sub-process is the number of trolleys loaded per man-hour. There is also a need to find an equivalent trolley unit. The method of estimation is the same as that used for the 'Order Picking' productivity measure. Each truck can take up to 24 trolleys and has a driver and one or two helpers. The number of man-hours is then determined.

The measures used for CASE A are summarized in Table 1.

Table 1. Productivity Measures for CASE A

Sub-process/Activities	Productivity Measures	Currently tracked by company?
Unloading of Goods Received, P_1	Number of pallets unloaded per man-hour	Yes (informally)
Putting Goods into Racks, P_2	Number of pallets put on rack per man-hour	No
Order Picking, P_3	Number of equivalent trolleys picked per man-hour	Yes (informally)
Pre-delivery Administration, P_4	Number of trolleys loaded per man-hour	Yes (informally)

CASE B

The four sub-processes identified for the illustration of process-based productivity measurement were 'Receiving', 'Put Away', 'Replenishment' and 'Order Picking'.

Receiving

Goods are delivered by lorry or container. The productivity measure for this sub-process is the number of pallets unloaded per man-hour. The number of cartons unloaded for each item and the item's pallet configuration is used to derive the number of pallets unloaded. The pallet configuration is the number of cartons of the item that can be placed on the pallet. All goods are delivered in carton form although some cartons may already be arranged on pallets. Usually, the unloading of the containers requires three people, while the unloading of lorries uses two people.

The unloading time for each lorry and container was noted down in a book by the VNA section that keeps track of deliveries. In addition, the number of cartons and the item code were also noted. An assumption underlying this measure is that the administrative activities for this sub-process do not affect the productivity of the sub-process. This assumption is reasonable because the administrative activities are simple tasks that can be performed very quickly.

Put Away

The productivity measure for this sub-process is the number of pallets put away per man-hour. The administrative activities of this sub-process are again not considered critical to its productivity. This is because the put away lists and labels are generated long before the physical transfer of goods is carried out. For this sub-process, the cartons of goods are already stacked according to the pallet configuration. There is no need to convert to pallet equivalent units. The time taken by each turret truck driver is indicated on the put away list.

Replenishment

The purpose of this sub-process is to replenish the pick-faces. These pick-faces are located at ground level of the high racks where the turret truck drivers or order pickers do order picking. The goods at these locations will be depleted as order picking takes place. Replenishment is done daily.

The productivity measure for this sub-process is the number of locations replenished per man-hour. A replenishment report is generated every day indicating the amount of replenishment needed at each location. One person will be assigned to do the replenishment and he will indicate the start and end time on the replenishment report, which will be verified by one of the supervisors. There is a need to convert the location to pallet equivalent units so that all the individual measures use the same units. Since one location can hold one pallet, one location is one pallet equivalent unit.

Order Picking

The productivity measure for this sub-process is the number of pallets picked per man-hour. Although the unit for the order picking sub-process is cartons, this should be converted to pallet equivalent units using the pallet configuration for the item so that the productivity measures are consistent. The number of cartons to be picked for each item is indicated on the picking request lists. In addition, each order picker has to indicate the start and end time on the picking request list he is assigned. The input data is therefore the man-hours.

The measures used in CASE B are summarized in Table 2.

Table 2. Productivity Measures for CASE B

Sub-process/Activities	Productivity Measures	Currently tracked by company?
Receiving, P_1	Number of pallets unloaded per man-hour	No
Put Away, P_2	Number of pallets put away per man-hour	Yes (informally)
Replenishment, P_3	Number of locations replenished per man-hour	No
Order Picking, P_4	Number of pallet equivalent units picked per man-hour	Yes (informally)

CASE C

The productivity of two intradepartmental sub-processes was tracked. They were 'Receiving Goods' and 'Pick and Pack':

Receiving Goods

Goods are delivered to the company by container or lorry as loose cargo. The productivity measure for this sub-process is total item quantity received per man-hour. One point to note is that each type of item is pre-packed in boxes with a fixed amount in each box. These boxes are not unpacked before they are put into the location. Both the item quantity received and the time taken are obtained from the shipping advice list. In addition, wrong or damaged shipments are not included in the total item quantity. The company does not track the productivity of this sub-process currently.

Pick and Pack

For this sub-process, the storekeeper is assigned to pick items based on the dispatch note. The productivity measure for this sub-process is the total item quantity per man-hour. The total item quantity is stated on the dispatch note. In fact, productivity is already being tracked by the company itself.

CASE D

Process-based productivity measurement is illustrated for all except six sub-processes in the operations of CASE D. The 'Airfreight Import Shipment' and 'Seafreight Import Shipment' sub-processes are not used because they involve external parties. The 'Airfreight Import Arrival Document Control', 'Seafreight Import Clearance', 'Airfreight Import Arrival Goods Transfer from SATS to Airport Warehouse' and the 'Pre-delivery Checking' sub-processes are not illustrated because they are compulsory administrative activities that are performed quickly. In addition, the transfer of goods from the airport and port are covered by a single productivity measure.

The management feels that the weight of any cargo handled should be used for all productivity measures to be developed. While weight may not be accurate, it is still representative as an output or input measure. More importantly, it is most easily available since it can be obtained from the Warehouse Operating System (WOS) that keeps track of all the goods the company handles.

Transfer of Goods from Airport Warehouse

There are two productivity measures for this sub-process as some goods are delivered direct to the customer location, while others are brought back to the main warehouse. Both measures use weight of goods transferred per man-hour. The weight of goods can be obtained from the clearance documents. In addition, the weight of damaged goods is excluded from the productivity calculation. The assumption is that customs clearance time is insignificant and quite constant, which is possible because airport personnel are known to be highly efficient. Another assumption is that clearance documents are returned to the JIT team immediately upon the return of the trucking team.

For transfers to the main warehouse, the total time taken includes travelling time to the airport and back. To minimize data collection, an average travelling time to the airport is used. The rest of the duration is derived from the arrival time of the trucking team at the airport warehouse and the time in which the clearance documents are returned to the JIT team. For transfers to the customer location, determination of the time taken is done in the same way. The two values obtained are then weighted to give the final productivity of this sub-process. The weight is based on the amount of goods that are going direct to customers and the goods that are brought back to the main warehouse.

Transfer of Goods from Port

This sub-process is similar to the previous one except that we are now dealing with goods arriving by seafreight. The productivity measure is the weight of goods transferred per man-hour. The assumption is that again customs clearance time at the port is insignificant and quite constant. The time taken is the difference between the time when clearance documents are issued to the trucking team and the time the documents are returned to the JIT team. The weight of cargo transferred is obtained from clearance documents, excluding the weight of damaged goods. The two productivity values obtained are then weighted to give the final productivity of this sub-process. The weight is based on the amount of goods that are going directly to customers and the goods that are brought back to the main warehouse.

Receiving Goods Administration

When goods arrive at the main warehouse, they must first be unloaded. The productivity measure for this sub-process is the weight of goods unloaded per man-hour. The administrative activities for this sub-process are assumed to have little effect on productivity. The weight of goods received can be obtained from delivery orders or the WOS. Data regarding the time taken and the number of people involved need to be collected.

Put Away/Racking

The productivity measure for this sub-process is the weight of goods put away per man-hour. The weight of goods can be found in the WOS, while data on the time taken need to be collected.

Order Picking

This sub-process is a sequential combination of the 'Order Picking Administration' and 'Order Picking' sub-processes. They are combined for two reasons. First, they are performed to ensure that the goods are efficiently prepared for the JIT customer. Thus, they have the same objective. Secondly, the administrative sub-process, although not dispensable, can be performed quickly and sometimes concurrently. Therefore the time taken for administrative activities is only a small proportion of the time for order picking.

The measures used in CASE D are summarized in Table 3.

Table 3. Productivity Measures for CASE D

Sub-process/Activities	Productivity Measures	Currently tracked by company?
Transfer of Goods from Airport and Port, P_1	Weight of goods transferred per man-hour	No
Receiving Goods Administration, P_2	Weight of goods unloaded per man-hour	No
Put Away, P_3	Weight of goods put away per man-hour	Yes (informally)
Order Picking, P_4	Weight of goods picked per man-hour	Yes (informally)

NEW PRODUCTIVITY IMPROVEMENT APPROACHES

The productivity measures developed earlier are now used to illustrate the interrelatedness of the systems approach. In each case, the input and output measures are first converted into the same units. However, there is no established standard in all the companies. Given that the major sub-processes in most of these companies are order picking and receiving, an attempt is made to develop a standard based on these two sub-processes. The overall process in each case refers to the sequential sub-processes that are used to demonstrate process-based productivity measurement.

In each case, three kinds of productivity are determined - Sequential Productivity, Sequential Contribution and Isolated Productivity. The productivity measures for each sub-process are determined using the average sub-process input and output obtained from the data collection process. The values for Sequential Productivity are verified using the two formulae explained earlier. As long as the Sequential and Isolated Productivity values are greater than one, that particular process/sub-process is productive compared to the standard. The first three models show how process-based productivity can be applied to intradepartmental sub-processes, while the last model (Worldwide Logistics Singapore) demonstrates its application in cross-departmental sub-processes.

CASE A

There are basically two types of productivity measures for this case - number of pallets per man-hour and number of trolleys per man-hour. The outputs are converted into volume so that they are in the same units. The volume of a full trolley is based on the dimensions of the trolley (0.9m by 0.6m by 1.55m) stacked to the weighted average maximum height (1.66m) allowed by the racks.

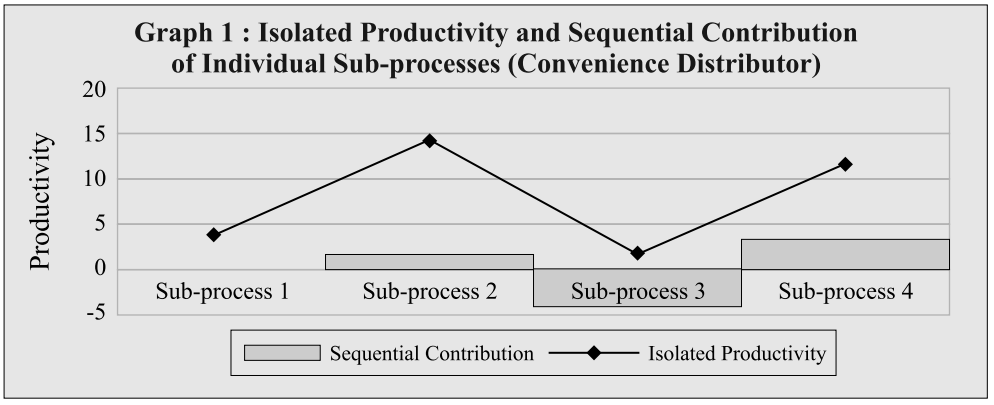
Man-hours are converted into volume or vice versa. The intention is to find the daily average quantity of goods handled by the company from the major sub-processes that make up its operations. The standard used as a guide to translate man-hours into volume for developing the productivity model is 2.9 m^3/man-hour. The productivity values are shown in Table 4.

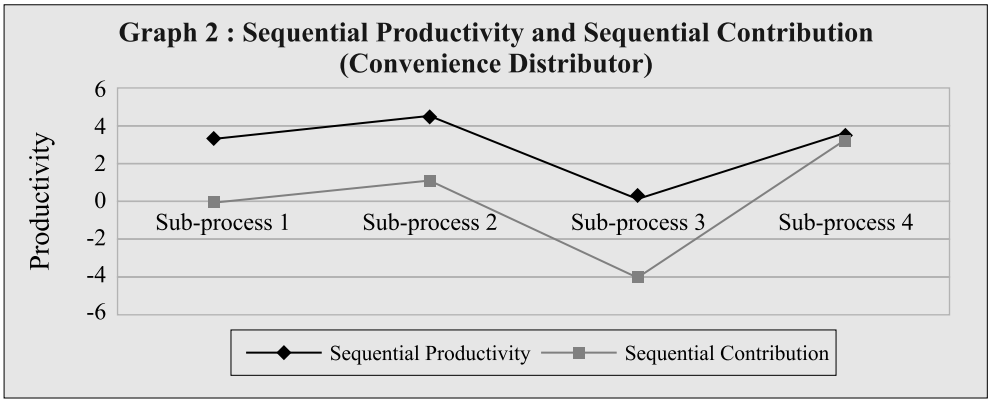
Table 4. Productivity Values for CASE A

Sub-process/Activities	Productivity Measures		
	Isolated Productivity	Sequential Productivity	Sequential Contribution
Unloading of Goods Received, P_1	3.27 (3)	3.27 (3)	-
Putting Goods into Racks, P_2	14.38 (1)	4.35 (1)	1.08 (2)
Order Picking, P_3	1.81 (4)	0.33 (4)	-4.03 (3)
Pre-delivery Administration, P_4	11.89 (2)	3.32 (2)	2.99 (1)

Note: The numbers in brackets are rankings for each productivity measure.

These values are also shown in Graphs 1 and 2 for the purposes of clearer illustration.





Graph 1 shows that Sub-process 2 has the highest Isolated Productivity, while Sub-process 3 has the lowest. However, all four sub-processes are productive in isolation. Hence, there is a need to look at each sub-process in relation to the whole process. While Sub-process 2 has the highest Isolated Productivity, its Sequential Contribution does not have the highest value. The highest Sequential Contribution value comes from Sub-process 4, while Sub-process 3 has the lowest. This implies that Sub-process 4 improves the productivity of the process greatly but Sub-process 3 suppresses its effect. As suggested by the Sequential Productivity graph, the process is most productive when the first two sub-processes are performed but becomes unproductive when Order Picking is added into the process. Suggestions for improvement are summarized in Table 5.

Table 5. Suggestions for Improvement in CASE A

Sub-process/Activities	Suggestions for Improvement
Unloading of Goods Received	• Improve Isolated Productivity
Putting Goods into Racks	• Improve co-ordination between Sub-processes 1 and 2
Order Picking	• Improve co-ordination between Sub-processes 1, 2 and 3 • Improve Isolated Productivity
Pre-delivery Administration	• Improve Isolated Productivity

CASE B

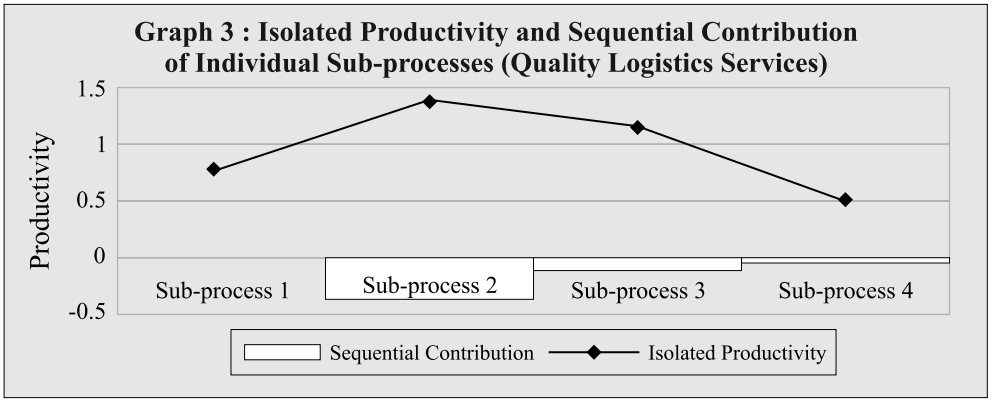
All the productivity measures formulated used number of pallets per man-hour. Thus, there is no need to harmonize the measures and only conversion of the input and output into the same units is needed. A standard of around 13.20 pallets/man-hour is used. The productivity values are shown in Table 6.

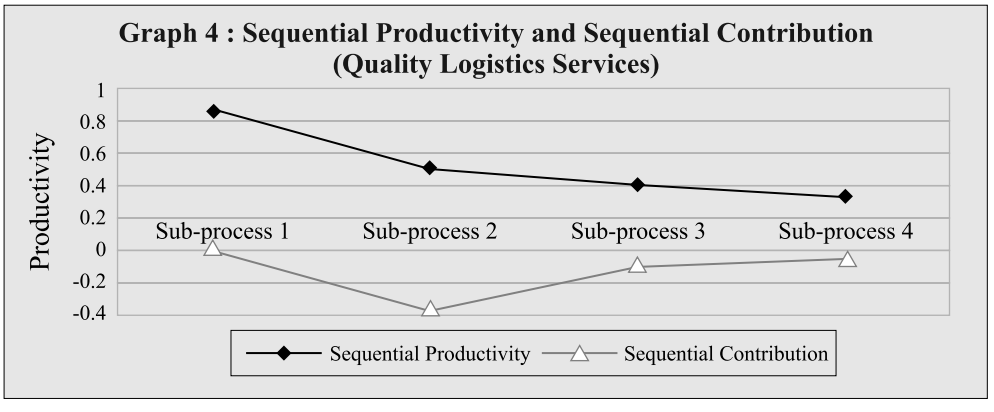
Table 6. Productivity Values for CASE B

Sub-process/Activities	Productivity Measures		
	Isolated Productivity	Sequential Productivity	Sequential Contribution
Receiving, P_1	0.86 (3)	0.86 (1)	-
Put Away, P_2	1.38 (1)	0.50 (2)	-0.36 (3)
Replenishment, P_3	1.13 (4)	0.42 (3)	-0.08 (2)
Order Picking, P_4	0.52 (2)	0.38 (4)	-0.05 (1)

Note: The numbers in brackets are rankings for each productivity measure.

These values are also shown in Graphs 3 and 4 for the purposes of clearer illustration.





Graph 3 shows that Sub-process 4 has the lowest Isolated Productivity, while Sub-process 2 has the highest. Sub-processes 1 and 3 are by themselves unproductive. This shows that the highest Isolated Productivity does not necessarily result in the highest Sequential Contribution. In fact, looking at the Sequential Contribution, none of the sub-processes has a positive effect on process productivity. However, Sub-process 4 seems to be the best since it has the smallest negative value, although its Isolated Productivity is the lowest. We can observe from Graph 4 that there is a downward trend in Sequential Productivity but this begins to taper off after Sub-process 3. This may suggest that improvement in the co-ordination between Receiving and Put Away is needed. This is again mirrored by the graph for Sequential Contribution. Suggestions for improvements are summarized in Table 7.

Table 7. Suggestions for Improvement in CASE B

Sub-process/Activities	Suggestions for Improvement
Receiving	• Improve Isolated Productivity
Put Away	• Improve co-ordination between Sub-processes 1 and 2
Replenishment	• Improve co-ordination between Sub-processes 1, 2 and 3 • Improve Isolated Productivity
Order Picking	• Improve co-ordination between Sub-processes 1, 2, 3 and 4 • Improve Isolated Productivity

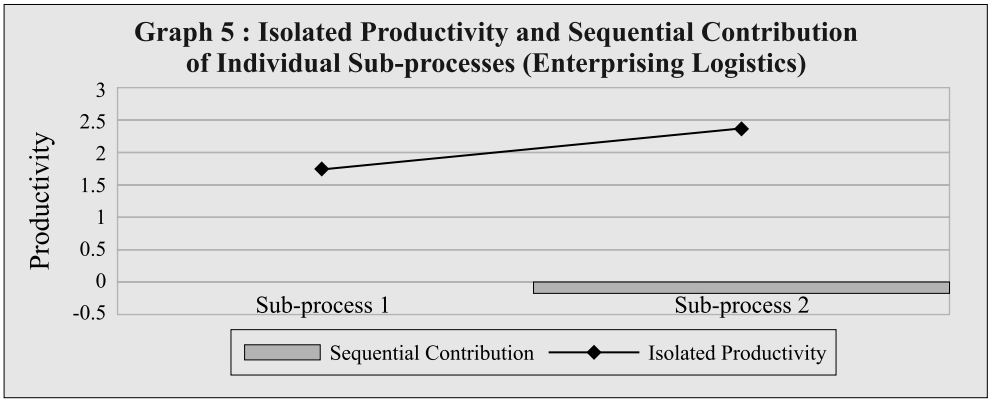
CASE C

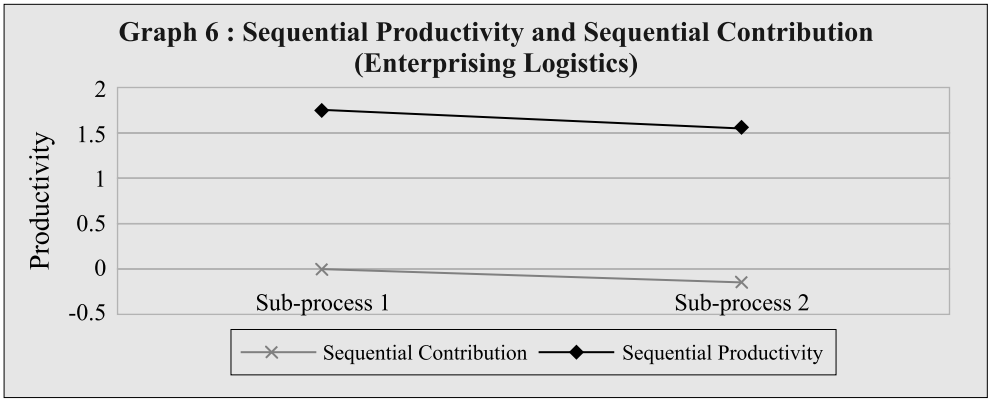
The productivity of two sub-processes was measured. This is an example of measuring the productivity of a system within another system. CASE C basically performs the 'Receiving Goods' and 'Pick and Pack' sub-processes. The productivity of both sub-processes is measured in item quantity per man-hour. Thus, the standard to convert man-hours to the item quantity equivalent derived from these sub-processes is 48.34 items per man-hour. The productivity values are shown in Table 8.

Table 8. Productivity Values for CASE C

Sub-process/Activities	Productivity Measures		
	Isolated Productivity	Sequential Productivity	Sequential Contribution
Receiving Goods, P_1	1.72	1.72	-
Pick and Pack, P_2	2.38	1.55	-0.17

These values are also shown in Graphs 5 and 6 for the purposes of clearer illustration.





This is a simple application of process-based productivity measurement for a two-sub-process system. From Graph 5, it can be seen that both sub-processes are productive (>1) based on their Isolated Productivity. However, when the 'Pick and Pack' sub-process (Sub-process 2) is added to the 'Receiving Goods' sub-process (Sub-process 1), process productivity falls, as illustrated in the Sequential Contribution graph. Fortunately, the drop in process productivity is not significant enough to cause the process to be unproductive (productivity <1). Since Sub-process 2 is quite productive, CASE C can look into improving the co-ordination between the two sub-processes.

CASE D

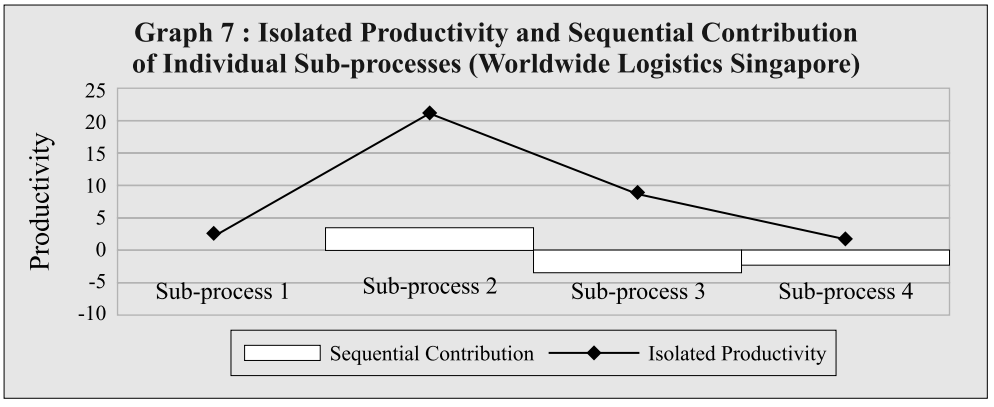
The unit of measurement for the productivity of individual sub-processes is weight per man-hour. Therefore, a standard of 241.7kg per man-hour is used to convert one man-hour to an equivalent weight unit. It should be noted that the transfer of goods from the airport and port would have only one combined measure, though the individual sub-process measures would still be collected. The productivity values are shown in Table 9.

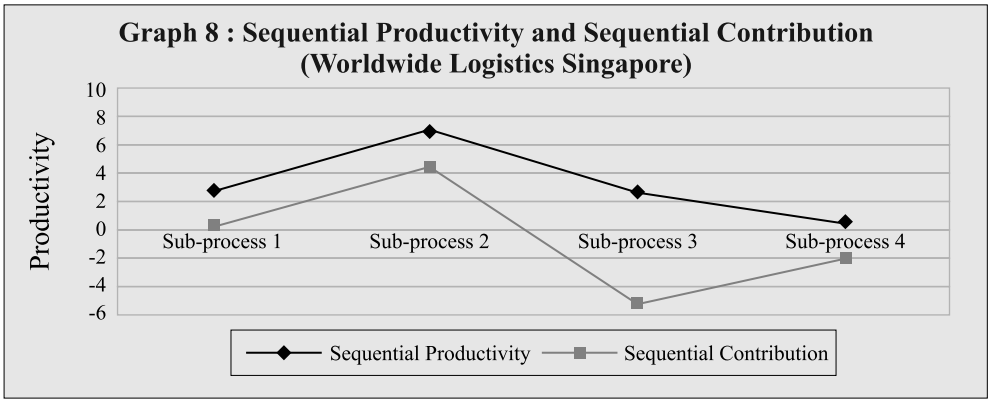
Table 9. Productivity Values for CASE D

Sub-process/Activities	Productivity Measures		
	Isolated Productivity	Sequential Productivity	Sequential Contribution
Transfer of Goods from Airport and Port, P_1	2.89 (3)	2.89 (2)	-
Receiving Goods Administration, P_2	20.85 (1)	7.47 (1)	4.5751 (1)
Put Away, P_3	8.61 (2)	2.71 (3)	-4.7612 (3)
Order Picking, P_4	2.04 (4)	0.38 (4)	-2.3324 (2)

Note: The numbers in brackets are rankings for each productivity measure.

These values are also shown in Graphs 7 and 8 for the purposes of clearer illustration.





It can be seen from Graph 7 that all the four sub-processes are very productive in isolation. Sub-process 2 has the highest Isolated Productivity, and even the relatively less productive Sub-process 4 has an Isolated Productivity value of 2.04. The same graph also shows that only one sub-process, Sub-process 2, makes a positive Sequential Contribution to process productivity. Incidentally, unlike the other cases, this sub-process is also the one with the highest Isolated Productivity. The rest of the sub-processes, however, cause process productivity to fall when they are performed sequentially. From Graph 8, it is observed that the overall process is unproductive, although individually all sub-processes are very productive. This suggests that perhaps the company can look into how the sub-processes can be further co-ordinated. Suggestions for improvement are summarized in Table 10.

Table 10. Suggestions for improvement in CASE D

Sub-process/Activities	Suggestions for Improvement
Transfer of Goods from Airport and Port	• Improve Isolated Productivity
Receiving Goods Administration	• No improvement needed at the moment
Put Away	• Improve co-ordination between Sub-processes 1, 2 and 3 • Improve Isolated Productivity
Order Picking	• Improve co-ordination between Sub-processes 1, 2, 3 and 4 • Improve Isolated Productivity

Implications for Productivity Management

One important lesson that can be drawn from the study is that Isolated Productivity measurements can be misleading. While it is inappropriate and insufficient for a systems approach, this traditional approach to measurement is commonly used. The study shows that for the process approach, Isolated Productivity can assist in productivity improvement, but only after unproductive sub-processes are identified using Sequential Contribution.

The study also shows that the addition of a very productive sub-process does not always increase the productivity of a process. As seen in Sub-process 2 for CASE B, productivity decreases due to the fact that co-ordination between sub-processes is not good. For example, the pallets of goods put away are not placed properly to support order picking. Although the order picking by itself may be very productive, when employees pick the goods from the racks their productivity will be affected and the productivity of the process will decline.

Co-ordination problems need not be limited to two sequential sub-processes. For example, when unloading goods onto pallets for receiving, those with the earliest expiry date are not stacked on top to facilitate picking. The put away personnel just bring the pallets to the racks. The productivity of the process will be affected when order picking is performed since goods with earlier expiry dates should be picked first. In fact, this co-ordination problem can be viewed as a sub-optimization.

Sequential Contribution and Sequential Productivity graphs are useful for companies adopting a process approach to productivity management. First, the Sequential Contribution graph shows the impact on productivity of the addition of a sequential sub-process. However, it is not enough to know this. Managers will want to know the eventual productivity of the whole process. This can be shown by the Sequential Productivity graph. In addition, the Sequential Contribution graph will indicate to managers where to focus their productivity improvement efforts. Sub-processes that have the most negative impact on the overall productivity of the process require management attention.

Before deciding on improvements, management needs to understand both the Sequential Contribution and the Isolated Productivity of the sub-processes concerned. A sub-process that has a negative effect on the productivity of the process may not be unproductive by itself. Its Isolated Productivity may be high, but there may be a lack of co-ordination between the sub-process and the preceding one. Therefore, it makes no sense to devote resources to improving the sub-process that is already very productive by itself. Instead, efforts could be concentrated on improving the co-ordination between the two sub-processes. For example, goods are placed at the loading bay after order picking. If they are not placed in a manner to facilitate smooth loading, the productivity of the process will suffer even if the dispatch personnel can load the goods very quickly. They will still need to look around for the goods to load onto their vehicles.

A review of the drawbacks of a traditional approach to both general and productivity management suggests a move towards process-based management is desirable. Managers should now concentrate on the process and sub-processes and their interrelatedness in managing their companies. With the illustration of how a systems approach can be used for productivity management, managers will now have a measurement system that will provide concrete numbers to assist them in their efforts.

In order to perform to its potential, this system must be supported by a good information system that generates the accurate and timely data it needs. This has been a major obstacle in the process productivity measurement effort. The information systems observed in the study were good as they served the needs of the companies concerned. However, they were found wanting in terms of generating data for process-based productivity measurement. Some data were either not captured, were not in the right form or were inaccurate because physical and informational flows were not fully integrated. For companies that already have computerized information systems, this problem may be overcome without committing a lot of resources compared to those whose information systems are manual. However, with the introduction or modification of existing information systems, there is still a need to consider the effects on the process and the human reaction.

Implications for the Logistics Industry

The results of the development of the productivity models described in this paper suggest that more research can be done to determine how better co-ordination between sub-processes in logistics can be achieved. While this may be difficult for the industry in general since processes are unique, the management of individual companies should continuously look to improve their sub-processes. This can aid discovery of new and better ways of performing a sub-process more efficiently and effectively, as well as improving co-ordination between sub-processes.

In order to overcome labor constraints and work in a lean environment, employees in all four cases documented above were generally cross-trained. Usually, the flexible use of labor improves productivity. The results derived from the productivity models are, however, inconclusive as to whether flexible use of labor in logistics has positive impacts on productivity. Therefore, management has to decide for itself whether to cross-train its employees according to their ability, the requirements of the activities concerned and the resources available. If labor is to be used flexibly, then management has to review its sub-processes to determine how they can be better co-ordinated to enjoy the benefits of labor flexibility.

CASE B and CASE D also provide the industry with some productivity numbers on the effect of further outsourcing by logistics service providers. Based solely on Isolated Productivity, it appears that the trucker for CASE D (2.89) is productive and is perhaps an asset to its operations. On the other hand, the unloading of goods by subcontractors and lorry drivers for CASE B is not productive (0.86). Perhaps the company can look into providing incentives to improve Isolated Productivity or perform the tasks itself. However, the Sequential Contribution to process productivity in both cases cannot be determined because the outsourced sub-processes happen to be the first sub-processes in these productivity models.

CONCLUSIONS

The application of process-based productivity measurement in the four cases illustrated has shown that some obstacles and problems must be overcome before this approach can be used practically. However, they are not specific to process-based productivity measurement. Traditional productivity measurement faces similar problems, albeit on a smaller scale. Despite these yet-to-be-resolved issues, these cases indicate that it is still possible to attempt to measure productivity using the process approach. This tool will be even more useful to managers who are already adopting process management. The productivity values and graphs generated will assist managers in making better decisions with regard to process productivity and justifying their actions.

In addition, the documentation of the measurement effort has also highlighted the importance of the components of a measurement system. It shows that the collection of data for such a system is not as simple as may be expected and depends on the measures that are developed. Moreover, it is difficult to ensure that data meets the criteria of validity, reliability and reactivity. In fact, the development of productivity measures and the determination of the type of data to collect are not a sequential process; instead they depend on each other.

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VIETNAM

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INTRODUCTION

To measure or not to measure is no longer the question. Measure we must, because we are living in a market economy where survival means winning against the competition. Modern competition is like war in the olden days. Winning battles is important but not at the expense of losing the war. The importance of making decisions based on complete knowledge of the facts and oriented towards the strategic aim of winning the peace was mentioned two and a half thousand years ago by the military genius, Sun Tzu, in his book *The Arts of War*, where he stated:

"The rules of the military are five:
- *Measurement;*
- *Assessment;*
- *Calculation;*
- *Comparison; and*
- *Victory.*

By the comparison of measurements you know where victory or defeat lies."

Peace and prosperity is the aim of a nation, and winning against the competition is our aim. This paper explores the conditions in which measurement can take place and help Vietnamese enterprises to improve productivity and to win.

THE EMERGING BUSINESS MANAGEMENT ENVIRONMENT IN VIETNAM

After five years of helping business enterprises to build quality systems to ISO 9000 standards, it has become clear that the concept of management as a distinct discipline and managers as a group of professionals is only recently but increasingly recognized in Vietnam. The organizations involved were of various types, including privately-owned and state-owned enterprises and joint ventures, and ranged in size from 80 to 500 permanent employees, not counting seasonal staff. They were from a number of industrial sectors such as electrical cables, frozen foods, packaging, and ceramics, as well as a testing laboratory that was one of five organizations in the service sector.

Without exception, the practice of collecting operational control or business performance data to provide an objective basis for management decision-making was not recognized as an essential function of management in these companies. Even in companies where process parameters were recorded for process monitoring, these data were not analyzed to detect trends for process improvement purposes.

What was the reason for this apparent apathy? After much discussion with the managers of client enterprises, the answer became obvious. Like managers elsewhere, Vietnamese managers must do what they believe to be the first thing first - that is, survive until the next day. When one manages by the seat of one's pants, it is not easy to think about improvement.

However, once a company has built and successfully operated a quality management system with the objective of obtaining ISO certification, it can then begin to see the need to collect and analyze data for process control and corrective and preventive actions. Only at this stage does the business enterprise start to manage by objectives and plans, and to solve problems based on the facts of the situation.

There is a lesson to be learned from the above observation, which is the main thrust of this paper: there must be the right environment before measurement of any kind can be effective.

THE ENVIRONMENT FOR EFFECTIVE AND PROFITABLE MEASUREMENT

This may be old news for many people, but for those who are involved in helping businesses to be effective and competitive in a developing country, it may be important. The right environment for the effective measurement of productivity may consist of the following conditions:

- There must be a 'quality' definition of productivity. This means a shift from productivity as a ratio relating merely to *things* to productivity as a ratio of *values* as conceived by customers or consumers. There needs to be a shift from a 'production factors focus' to a '*customer satisfaction focus'*.
- There must be a structure, viz. a quality management system, to effectively translate 'customer focus' concepts into specific actions to allow everyone within the organization to satisfy the customers. The quality management system is best built to at least meet the requirements of the ISO 9001/2 international standard. This creates the framework to assure the achievement of objectives, which in turn enables continual improvements to take place.
- The commitment to achieve better and better business results through quality improvement forces management into the practice of measuring operational parameters and business indicators in order to monitor the improvement of products and processes and the achievement of quality objectives and to solve problems.
- Once free from the daily crisis type of management through the effective operation of the quality management system, management is ready to take improvement action. This will be reinforced by the requirements of the ISO 9001:2000 standard, which demands the deployment of *quality objectives* to appropriate organizational levels and evidence that every employee knows his or her contribution to the achievement of such objectives.
- The transition from the 1994 version of ISO 9001/2/3 to ISO 9001:2000 will have a definite and beneficial impact on the requirements for measurement. ISO 9001:2000 requires enterprises to measure *customer satisfaction and dissatisfaction* and it forces businesses to prove *process capacity*. This will require measurement of business or operational factors of one kind or another. With the appropriate data and skills in the application of statistical techniques, the possibilities are limitless.

The central theme of this paper may validate the decision of the Vietnamese government to make building a quality management system that meets ISO 9000 requirements national policy for business and government enterprises. This may be the best news from Vietnam that can be brought to this symposium.

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Symposium on Productivity Measurement in the Service Sector (SYP-12-00)
1-4 August 2000, Kuala Lumpur, Malaysia

PROGRAM AND SCHEDULE

Date/Time	***Activity***
Tuesday, 1 August	
Morning	Inaugural session Session I: Presentation and discussion on *The Productivity Framework, Productivity in the Service Sector & the Productivity Paradox* by Dr. Ab. Wahab Muhamad, Deputy Director-General, National Productivity Corporation, Malaysia
Afternoon	Session II: Presentation on *Productivity Measurement in the Service Sector* by Mdm. Rauzah Zainal Abidin, Consultant, National Productivity Corporation, Malaysia Session IIIa: Presentation and discussion on *Current Approaches to Measurement within the Service Sector and Service Sector/White Collar Institutions* by Mr. John Parsons, Chief Executive, Resource Alternatives (Botswana) Pty Ltd, Botswana
Wednesday, 2 August	
Morning	Session IIIb: Presentation and discussion on *Different Measurement Approaches and Value-Added Calculation in the Service Sector - the Japanese Perspective* by Mr. Kiyoshi Wainai, Certified Public Accountant, Japan, and Prof. Masayoshi Shimizu, Faculty of Business Administration, Yamanashi Gakuin College, Japan Session IV: Presentation and discussion on *Data to Information, Information to Knowledge, and Knowledge to Decisions and Actions* by Mr. John Parsons
Afternoon	Session V: Presentation and discussion on *Productivity Statistics (Hotels and Ports)* by Mr. Mohd Ramli Abd. Rahman, Senior Consultant, National Productivity Corporation, Malaysia Country paper presentation

Thursday, 3 August

Morning	Session VI: Presentation and discussion on *The Malaysian Customer Satisfaction Index for the Service Sector* by Dr. Nooreha Husain, Managing Director, AD-MACS Corp (M) Sdn. Bhd., Malaysia
	Country paper presentation
Afternoon	Country paper presentation
	Session VII: Presentation and discussion on *Benchmarking Experiences in Malaysia* by Mr. Abd. Latif Abu Seman, Manager, Best Practices Division, National Productivity Corporation, Malaysia

Friday, 4 August

Morning	Syndicate discussion and report presentation
	Summary session
	Evaluation and closure

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